Clinical Pathway versus Traditional Care Plan method for Caring of Postoperative Children Undergoing Cardio thoracic Surgery

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Abstract: A clinical pathway is developed to be the ideal plan of care for post operative children undergoing to cardio thoracic surgery. Similarly, some conditions and procedures may have more variable outcomes than others. Although the heterogeneity of children and procedures are important factors in considering the potential impact of clinical pathway. **Aim:** This study aimed to compare between the traditional nursing care and clinical pathway in planning for caring of postoperative children undergoing cardio thoracic surgery. **Methods:** A quasi-experimental design was utilized to conduct this study, the study was carried out at Abou-El Resh Talabah Hospital affiliated to Health Insurance and El-Demerdash Hospital affiliated to Ain Shams University Hospital**. Sample: Nurses group:** A convenience sample consisted of 100 nurses caring for post operative children undergoing cardiothoracic surgery at the previously mentioned study settings. **Patients group:** A convenience sample of 200 children who were admitted for cardiothoracic surgery in the previously mentioned study settings was recruited for pre and post clinical pathway intervention. Tools of data collection **are: Questionnaire format, Observation checklists, Child patient assessment sheet and Clinical pathway map. Results:** the percent score of total observation of the care of children patients in the pre-intervention stage study and control groups showed that the scores were very low in both groups. Nonetheless, the score of performance was higher among nurses in the control group (28.8±3.5) compared to those in the study group. **Conclusion:** In the light of the current study it can be concluded that, nurses' knowledge about heart diseases in pediatric is generally low and their performance of postoperative care for post operative open heart surgery is unsatisfied. While after the implementation of the clinical pathway the significant improvements in nurses' knowledge and performance was observed; all the areas were adequately performed by almost all nurses for almost all children in the study group. This is reflected on child's outcomes as measured by the length of hospital stay, which was significantly shortened in comparison to pre-intervention stay as well as control group stay. Meanwhile, the clinical pathway team members namely, nurses and resident physician acquired good knowledge about the clinical pathway and the satisfaction level improved post implementation. **Recommendations:** Further studies should be carried out on a large number of nurses for evidence of results and generalization.
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Key words: Clinical pathway, traditional care, post operative, children, cardiothoracic surgery

1. Introduction:

Cardio thoracic surgery is a condition of physical origin that has lasted or is expected to last more than three months, and resulted in limitation in age appropriate school, play, or recreational activities. The child with cardiothoracic surgery needs to achieve the same basic developmental tasks of normal children. Chronically ill children miss their developmental achievement, assessment, screening, and immunization. The limitations imposed by chronic conditions have definite implications for each age group. The age of onset of a chronic condition affects the progression from one developmental stage to the next. Achieving a developmental task that has been acquired is very different from regaining a skill, which was previously mastered and now lost ***(Nasr, 2001).***

The clinical pathway is a tool for tracking a patient's progress toward achieving positive outcome within specific time frames. These pathways are continuously reviewed and evaluated in the light of clinical evidence. Many hospitals, managed care facilities, and home health service nationwide use clinical pathway or care mapping to coordinate care for caseloads of patients. Clinical pathways based on current literature and clinical expertises have been developed for certain common health problems especially in pediatric field ***(Kinsman, 2009)***.

The process of critical pathway development and implementation consists of the following steps: Identify target patient population, procedure, or disease category. Educate staff about critical pathways. Convene a multidisciplinary group of care providers. Identify ideal key outcomes and corresponding timeline for accomplishment of key outcomes. Gather information, which may include chart audits. Develop critical pathway based on ideal, realistic, or current practice. Educate the staff about

the critical pathway and the implementation plan. Implement the critical pathway (***Lumsdon (2008***).

Evaluate the critical pathway periodically. Insert new alternatives, interventions, and plans into the critical pathway to improve performance and reevaluate the critical pathway after each adjustment. The process also includes evaluation of a health care facility's current process of care and review of medical evidence and external practices **(Fallon, et al., 2013).**

Goals of Clinical pathway: Clinical pathway is used as means to reduce the length of hospitalization. However, clinicians have recognized many other goals for such pathways, the most important of which is the need to improve the quality of children care. Physicians and nurses involved in developing clinical pathways should focus on the positive aspects of pathway and use them as a means to advance medical care **Clinical Pathway in Nursing:** Advanced practitioners including nurse practitioners (NPs) and physician assistants (Pas) are contributing to care for critically ill children specially undergoing of abdominal surgery, through their participation on the multidisciplinary team and in collaborative physician practice roles. In the acute and critical care setting, NPs and PAs are most commonly used to provide care to critically ill patients as members of the medical care team. NPs and PAs have been increasingly used in the management of hospitalized children (**Ruth,et al., t, 2010).**

Nursing staff should be included in the development, implementation, and continual evaluation of any pathway. They need to understand their roles in helping ensure that best practices and good patient care are incorporated into critical pathways. Education about the disease state and the critical pathway is imperative at all levels, from the beginning of the development process through the piloting stage, organization or hospital wide implementation and the continuous monitoring process. It is important to use and adapt the current systems in place in the development of the critical pathway. Information needs to be easily obtained and followed on a daily, ongoing basis ***(Hausman, 2010)***.

Nurses have a key role in all aspects of clinical pathway use. Participating in the development of the pathway is the first step. Because they begin and end the chain of staff involved in delivering care, nurses possess a unique perspective in how health care systems work to enhance or impede the delivery of care. Pediatric Nurses are also responsible for initiating the pathway on appropriate patient's children and ensuring that the various events occur as planned. In some care settings or conditions, case managers who are advanced practice nurses closely follow pathway children; in others, staff nurses or community-based nurses function as case managers. In any environment, enhancing and monitoring outcome achievement is a nursing activity. Children with heart surgery are often given a printed pathway for reference. The pathway describes the care plan in simple language and pictures. The nurse discusses the pathway with the families of the children and focuses on achieving specific outcomes **(*Moder et al., (2008)***

Traditionally, nurses have been taught how to assist children and their families to resolve actual and potential problems by using the nursing process as documented in care plans. However, the format for documenting the nursing process has changed from the traditional care plan to the clinical pathway format ***(Hausman, 2010)***.

Clinical pathways can also assist professional schools of nursing to address curricular issues that will shape future graduates who must possess skills necessary to meet the evolving health care needs of the public. Clinical pathway can be used to teach the application of the nursing process in multiple educational settings such as hospitals and community-based centers, including school health clinics, ambulatory clinics, home health settings, gerontology centers, mental health centers, child day care facilities and shelters ***(Capuano, 2009)***.

A clinical pathway is developed to be the ideal plan of care for children undergoing of heart surgery. Similarly, some conditions and procedures have more variable outcomes than others. Although the heterogeneity of children and procedures is an important factor in considering the potential impact of clinical pathway ***(Steinberg, 2009)***.

The availability of a plan can promote quality and efficiency later in the hospitalization. In addition, high rates of "success" as expressed as the percentage of children needs, who meet length of stay goals for a clinical pathway, do not actually mean the clinical pathway is "good." They mean that the length of stay goal is not sufficiently ambitious (***Jenkins, 2008)***

Traditionally, nurses have been taught how to assist children with heart disease and their families to resolve actual and potential problems by using the nursing process as documented in care plans. However, the format for documenting the nursing process has changed from the traditional care plan to the clinical pathway format**.** Both of these documentation formats rely on the nursing process. To review briefly, the nursing process is a method of organizing thought processes for clinical decision making and problem solving. It allows nurses to focus on patients' individual responses to actual and potential health care problems, and to think and reason critically and perform psychomotor and affective skills to plan care for children ***(Capuano, 2009)***.

The clinical pathway may replace care plans previously used, but it does not replace the nursing process; rather it provides an innovative method of documenting assessment, diagnosis, planning, implementation, and evaluation specific for each day of care. Traditional care plans often focused on completion of nursing tasks without addressing the impact of other disciplines on cost issues in the care of patient child with open heart surgery **(Fraver, 2014)**

Aim of the study:

This study aims to:

– Compare between the traditional care plan method and clinical pathway for caring ofof postoperative children undergoing cardio thoracic surgery.

Research Hypothesis:

– The study hypothesis that the clinical pathway will be better than traditional care plan method for caring of postoperative children undergoing cardio thoracic surgery.

Subjects and Methods:

Operational definitions:

Clinical Pathway: Means guidelines for all health care providers to follow in orders to meet expected patient outcomes. They are structured, multidisciplinary plans of care. They are also called care maps, critical pathways, standards of care or practical guidelines, clinical protocols, collaborative plans of care, anticipated recovery paths, multidisciplinary action plans, parameters, and benchmarks ***(Blancett, 2007)***.

Nursing: Means a profession within the health care sector focused on the care of individuals, families, and communities so they may attain, maintain, or recover optimal health and quality of life.

Traditional care plan: Means completion of nursing tasks focusing on the patient problems without addressing the impact of other disciplines on the issues in the care of patient

Congenital heart defect (CHD) or congenital heart anomaly: Means a defect in the structure of the heart and great vessels that 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 do not need treatment, but some complex congenital heart defects require medication or surgery.

Cardio thoracic surgery: is a surgery done to repair congenital heart defects and heart diseases in children. It is classified into open heart surgery and closed heart surgery. In open heart surgery an incision is made through the sternum while, closed-heart surgery the incision is made on the side of the chest between ribs which is called a thoracotomy ***(Webb et al., 2007).***

Postoperative children: Means care given after surgery until the child patient is discharged from the hospital.

Research design:

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

Setting:

The study was carried out at, Abou-El Resh Talabah Hospital affiliated to health insurance and El-Demerdash Hospital affiliated to Ain Shams University Hospital**.**

Subjects:

The subjects of the present study consisted of three groups, namely nurses and patients, and the clinical pathway team.

1. ***Nurses' group*****:** A convenience sample consisted of 100 nurses caring for postoperative cardiothoracic surgery at the previously mentioned study settings. Their educational level was diploma, diploma with specialty, and Bachelor Degree in Nursing Sciences. There were no exclusion criteria.

2. ***Children's group:*** A convenience sample of 200 children who were admitted for cardiothoracic surgery in the previously mentioned study settings was recruited. These children were subdivided into the following groups:

A. **Pre-intervention groups:** these groups include 100 children. These children were served to compare the performance of the nurses at the pre-intervention phase to ensure similarity of their baseline performance and children's outcome. They were subdivided into:

– **Study group 1**: consists of 50 children under the care of the 50 nurses in the study group before the intervention.

– **Control group 1**: consists of 50 children under the care of the 50 nurses in the control group before the intervention.

B. **Post-intervention groups:** these groups include the other 100 children who served to compare the performance of the nurses in the study and control groups at the post-intervention phase to measure the effect of the implementation of the clinical pathway on their performance and on child's outcome. They were subdivided into:

– **Study group 2**: consists of 50 children under the care of the 50 nurses in the study group after the intervention.

– **Control group 2**: consists of 50 children under the care of the 50 nurses in the control group after the intervention. This second control group was used to avoid the effects of confounding factors and

co-intervention bias and contamination bias that would happen in case of the use of the first control group.

3. ***Clinical pathway team:*** consists of 50 nurses (study group) and six resident physicians caring for postoperative children undergoing cardiothoracic surgery at the previously mentioned study settings.

Tools of data collection

Four tools for data collection were used, namely a questionnaire format, an observation checklist, a patient assessment sheet and the clinical pathway map.

1. ***Questionnaire format (Appendix I)***: This self-administered questionnaire was designed in Arabic language based on reviewing the related literature to assess nurses' knowledge in relation to postoperative management of children undergoing cardiothoracic surgery. It was reviewed for validation by a group of experts in pediatric nursing, as well as medical cardiology and cardiothoracic surgery. The tool contained open questions, true and false questions and multiple choice questions. It consisted of two parts:

Part I: concerning demographic characteristics of the studied nurses as regard their age, sex, qualification, total years of experience, and their total years of experience in management of children undergoing cardiothoracic surgery.

Part II: concerning nurses' knowledge regarding:

- Heart diseases: definition, types, risk factors, signs and symptoms
- Causes and complications of open heart surgery.
- Nurse's role toward postoperative open heart surgery.
- Nurse's role in immediate postoperative care:
  - Preparations, importance of needed equipment
  - Specific investigations needed immediately after child admission to ICU.

Scoring system: for the knowledge items, a correct response was scored 1 and the incorrect zero. For each part, the scores of the items were summed-up and the total divided by the number of the items, giving a mean score for the part. These scores were converted into a percent score. The nurse knowledge was considered satisfactory level of knowledge if the percent score was 70% or more and unsatisfactory level of knowledge if less than 70%.

2. ***Observation checklists (Appendix II)***:

This tool was designed in English language based on review of pertinent literature ***(American Heart Association, 2008)***, to assess nurses' performance regarding to postoperative management of children undergoing cardiothoracic surgery. It was reviewed for validation by a group of experts in pediatric nursing, as well as medical cardiology and cardiac surgery. It included the main and specific nurses' performance activities related to immediate postoperative care for children undergoing cardiothoracic surgery. It assessed various tasks as regard child assessment on immediate ICU admission, care of child on ventilator, assessment of neurological status, suctioning technique, management of underwater seal, drainage & removal of chest tube, measuring central venous pressure, removal of central venous catheter, care of arterial pressure line, monitoring and maintaining intravenous infusion, discontinuing intravenous infusion, providing urinary catheter care, removing urinary catheter, and wound dressing.

Scoring system: In the observation checklists, the items "not done" and "done correctly" were scored "0" and "1", respectively. For each part, the scores of the items were summed-up and the total divided by the number of the items, giving a mean score for the part. These scores were converted into a percent score and means and standard deviations computed. The performance was considered competent if the percent score was 70% or more and incompetent if less than 70%.

- ***Child patient assessment sheet (Appendix III)***: This tool was designed in English language based on review of pertinent literature to identify the needs of post open heart surgery. It was reviewed for validation by a group of experts in pediatric nursing, as well as medical cardiology and cardiac surgery. It comprised five parts as follows:

Part I: socio-demographic data as regard child's age, sex and educational level

Part II: child's medical history: past medical history, past surgical history, special habits, and maintenance drugs

Part III: admission data including subjective and objective data

Part *IV*: physical assessment as regards neurological, cardiovascular, respiratory, gastrointestinal, urinary, and integumentary systems, as well as assessment of the activity pattern and hygienic measures.

Part V: health education for postoperative instructions for the child family.

Clinical pathway map (Appendix IV): It was designed in English language based on review of pertinent literature ***Anderson (1999)*** to use the clinical pathway for managing the children during the first week after open heart surgery. It was reviewed for validation by a group of experts in pediatric nursing, as well as medical cardiology and cardiac surgery. It included the main and specific nurse's performance activities related to immediate postoperative care for cardiothoracic surgery. The checklists included child assessment immediately upon ICU admission,

assessment of neurological status, suctioning technique, fluid management, management of underwater seal, drainage, removal of chest tube, reading central venous pressure, removal of central venous catheter, care of arterial pressure line, monitoring and maintaining intravenous infusion, discontinuing intravenous infusion, providing urinary catheter care, removing urinary catheter, and wound dressing.

II. Operational Design

The operational design consists of the preparatory phase, pilot study, validity and reliability of tools, fieldwork and limitations of the study.

Preparatory phase

Review of the past and current local and international related literature using articles, journals, scientific periodicals and text books to be acquainted with the various aspects of the research problem.

Pilot study

A pilot study was carried out on ten nurses and ten children to test the clarity, arrangement, and completeness of the items, and the time needed for each sheet. The final form was achieved through rearrangement and modification of the tools' items based on the findings of the pilot study. Some questions and items were omitted, added, or rephrased, and then the final form was developed. Those subjects were not included in the main study sample.

Tools validity and reliability

Content Validity

Content validity was checked before the pilot study and the actual data collection, through distribution of the tools to seven experts. Those were three pediatric nursing professors, three Professors in the field of cardiothoracic surgery and one statistical expert with a covering letter and explanation sheet that explains study, purpose, objectives and other related information to ensure appropriateness, relevancy, clarity and completeness of the tool. They were asked to agree/disagree on each item in the designed tools with comments for deletion, addition, or modification. The tools were finalized according to the opinions of these experts.

Reliability

Reliability was measured by using Alpha Chronbach's Coefficient which was equal to (0.86).

Fieldwork

Data collection was carried out in the period from December 2014 until May 2015. Data were collected from the three work shifts in postoperative intensive care units and postoperative surgical care units at Abou El-Rish Hospital and El-Demerdash Hospital. This was done four days per week: Sunday, Monday, Tuesday and Wednesday.

Nurses were informed about the aim of the study and invited to participate after giving their verbal consent. They answered the self-administered knowledge questionnaire in the presence of the researcher without referral to textbooks or colleagues, within 30-45 minutes. The performance checklists were filled by the researcher through observation of individual nurse's activities working in the postoperative intensive care units and postoperative surgical care unit during the three shifts. The nurses were observed while caring for children postoperative cardiothoracic surgery during the first week from the operation. Each nurse was observed three times and the average was calculated and recorded.

Child patient need assessment and physical examination were done postoperative and after stabilization of the child's condition. Verbal consent was obtained from the child's family or family caregiver for participation after explanation of the purpose of the study. The child patient need assessment sheet was filled in 30 to 40 minutes. The researcher obtained the medical history from the family and/or file.

Six physicians and ten nurses of the study group were constituted the clinical pathway monitoring team, in addition to the researcher. They were trained on the use of the clinical pathway variance map sheet. The training for the team of clinical pathway was done before starting the program. It lasted two weeks, five days each week, to orient them about the clinical pathway, how to use it and how to use the variance form. The researcher was the team leader to monitor how they are applying the clinical pathway, and correct any mistakes. So, the researcher was present all the time as the reference for any inquiry about the clinical pathway and was following and observing implementation of clinical pathway by the nurses and physicians.

Measurement of nurses' knowledge and performance, as well as child patient needs assessment were done for both study and control groups at the pre and post-intervention phases of the study.

Limitations of the study

- The tools used for data collection were composed of many parts, which needed a long time to be filled and applied
- The researcher was faced with some reluctance from the nurses in the study setting to participate in the study. Sometimes they refused or returned the forms incompletely filled. The researcher used some means for motivating them and reassured them about the confidentiality of any obtained information.
- There was also lot of resistance from other healthcare providers as physicians, physiotherapists, and other medical staff. This was particularly evident

with some consultants who had their own protocol; so, it was very difficult to convince them to follow the clinical pathway.

- Lack of or limited recourses, which is might affect the performance of the nurses.

III. Administrative Design

To carry out the study, the necessary approvals were obtained from the unit directors. Letters were issued to them from the Faculty of Nursing, Ain Shams University explaining the aim of the study to obtain the permission for data collection. Research ethics were followed including informing subjects about the study and obtaining their informed consent to participate, in addition to confidentiality of the data collected. The study maneuvers could not entail any harm to participants. Patient's children in the control group were receiving the standard care of the setting.

IV. Statistical Design

Data entry and statistical analysis were done using the Statistical Package for Social Sciences (SPSS) software version 14. Data were presented using descriptive statistics in the form of frequencies and percentages for qualitative variables, and means and standard deviations for quantitative variables. Quantitative continuous data were compared using Student t-test in case of comparisons between two groups. When normal distribution of the data could not be assumed, the non-parametric Mann-Whitney test was used instead of Student t-test. Categorical variables were compared using chi-square test. Whenever the expected values in one or more of the cells in a 2x2 tables was less than 5, Fisher exact test was used instead. In larger than 2x2 cross-tables, no test could be applied whenever the expected value in 10% or more of the cells was less than 5. Statistical significance was considered at p-value <0.05.

3. Results:

Figure (1) clarified that half (50%) of the studied sample has ventricular Septal Defect (VSD), while figure (2) illustrated that the highest percentage of the studied children had tachycardia and tachypnea

Table (1): showed that the majority of families in study and control groups received instructions in the pre-intervention, but it was almost only regarding the indication for the operation. With no statistically significant difference was revealed between study group and control group regarding instructions received

Figure (3): Concerning the sources of information for instructions received by families of the studied sample, Figure 3 illustrated that physicians were the major source in both groups, with no statistically significant difference between them.

Table (2): illustrated that none of the nurses sharing in the care of the two groups of pre-intervention stage of children had adequate performance of assessment. The only exception was related to assessment of fluids and electrolytes, which was adequately performed by 78.0% of the nurses in the control group ($p<0.001$). It is also noticed that no assessment was done for any of the items of the integumentary system in either group. Overall, the score of performance was higher among nurses in the control group (23.1±3.2) compared to those in the study group (17.5±1.8), $p<0.001$.

Table (3): Concerning ongoing care, Table 3 showed that none of the nurses in any of the two in the pre-intervention stage groups had adequate performance. The only exception was related to fluids and electrolytes balance measurement, which was adequately performed by all nurses in both groups, and apply effective ventilation, which was done by 48.0% of the nurses in the control group ($p<0.001$). Overall, the score of nurses' practice was higher among nurses in the control group (36.2±5.4) compared to those in the study group (27.7±3.5), $p<0.001$.

Table (4): illustrated that, none of the nurses in any of the two in the pre-intervention stage groups had adequate performance of nursing care provided to patients children. Meanwhile, nurses in the control group had higher scores of performance in almost all areas of care ($p<0.001$). It is also noticed that the total score of performance was higher among nurses in the control group (25.3±4.8) compared to those in the study group (18.9±5.2), $p<0.001$.

Table (5): Concerning ongoing ventilator care, Table 5 indicated that, none of the nurses in any of the two pre-intervention stage groups had adequate performance. However, the score of performance was higher among nurses in the control group (30.6±4.3) compared to those in the study group (26.8±4.5), $p<0.001$.

Figure (4): illustrated that, the percent score of total observation of the care of patients children in the pre-intervention stage study and control groups. It shows that the scores were very low in both groups. Nonetheless, the score of performance was higher among nurses in the control group (28.8±3.5) compared to those in the study group (22.7±2.4), $p<0.001$.

Table (6): As regards instructions received by patient's children and their families, statistically significant differences were revealed between post-intervention stage study group and control group all thirteen areas. On average, the mean number of instructions received was higher in the study group, compared to the control group, 12.5±0.3 and 1.2±0.1,

respectively, and the difference was statistically significant (p<0.001).

Figure (5): illustrated that, doctors were the major source of information in the control group, whereas nurses were the main sources in the study group and the difference was statistically significant (p<0.001).

Figure (6): showed that, almost all nurses sharing in nursing care of children in the post-intervention stage study and control groups were staff nurses.

Table (7): clear that all the areas of care were adequately performed by almost all nurses for almost all children in the study group at the post-intervention stage. Conversely, none of the children in the control group had adequate care in any of the areas except for fluids and electrolytes assessment (68.0%) and ongoing care (100.0%), and effective ventilation (50.0%). The percentages of adequate care were statistically significantly higher in the study group in all areas, except the ongoing care for fluids and electrolytes. Overall, 96.0% of the study group patients received adequate care, compared to none in the control group (p<0.001).

Table (8): clarified that, there was statistically significant improvements in the study group in all areas of observation in the post-intervention phase (p<0.001).

Figure (7): there were statistically significant improvements in the study group in total observation of the post-intervention phase, with all children having adequate care (p<0.001). It was noticed in the control group, none of the children received adequate care in any of the areas at either of the study phases.

Table (9): showed that 89.3% of the clinical pathway team members were nurses and 10.7% were physicians. Their mean years of experience were 1.8±4.2 years.

Table (10): showed that none of the clinical pathway team members had correct knowledge about any of the areas tested before the intervention. At the post-intervention phase, all of them had correct knowledge in all areas, and the differences were statistically significant (p<0.001).

Concerning the application of clinical pathway by nurses, **Table (11)** showed a decreasing trend of correct application from day one to day five, 26.0% and 2.0% respectively. Also, it was noticed that the incorrect application due to physician's defective performance or lack of resources or cooperation was always lower than due to deficient nurse's performance.

In total, 32.0% of the nurses had correct application of the clinical pathway (taking into account the incorrect application not due to their fault).

As demonstrated in **Table (12),** there were generally low percentages of nurses' satisfactory knowledge in all areas, except those related to risk factors and measurements. The only statistically significant difference between study group and control group was in relation to nursing role in Heart surgery (p=0.001), which was higher in the study group.

Table (13) indicated that, higher percentages of satisfactory knowledge in all areas among nurses in the study group. All these differences were statistically significant.

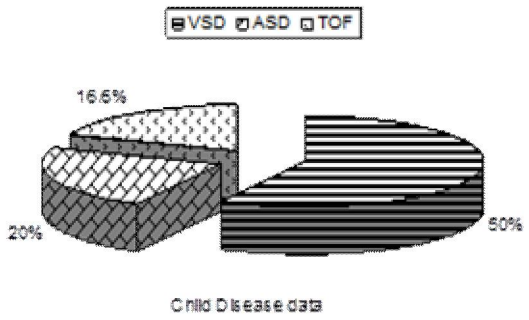


Figure (1): Percentage Distribution of Studied Children According to Their Disease.

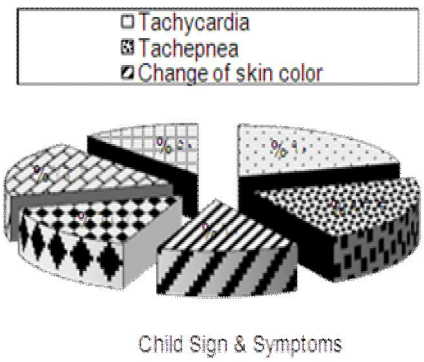


Figure (2): Percentage Distribution of Studied Children According To Their Signs and Symptoms of Disease.

Table (1): Number and Percentage Distribution of the Studied and Control Sample about the Instructions Received Pre-Intervention

Instructions Received	Patients				X^2 Test	p-value
	Study 1 (n=50)		Control 1 (n=50)			
	No.	%	No.	%		
Indication for the operation	42	84.0	47	94.0	2.55	0.11
Objective of the operation	0	0.0	0	0.0	Fisher	
Advantages of the operation	3	6.0	8	16.0	2.55	0.11
Possible complications of the operation	0	0.0	0	0.0	0.00	1.00
Expected length of stay in the hospital	1	2.0	1	2.0	Fisher	1.00
Postoperative care	0	0.0	0	0.0	0.00	1.00
Drugs	0	0.0	0	0.0	0.00	1.00
Diet	0	0.0	1	2.0	Fisher	1.00
Rest and exercise	0	0.0	0	0.0	0.00	1.00
Work	0	0.0	0	0.0	0.00	1.00
Follow-up after operation	0	0.0	1	2.0	Fisher	1.00
Warning signs	0	0.0	0	0.0	0.00	1.00
Action in emergency situation	0	0.0	0	0.0	0.00	1.00
Received instructions	42	84.0	47	94.0	2.55	0.11
No. of instructions:						
Range	0-2		0-4			
Mean±SD	0.9±0.5		1.2±0.8		U=3.69	0.055

(U) Mann-Whitney test

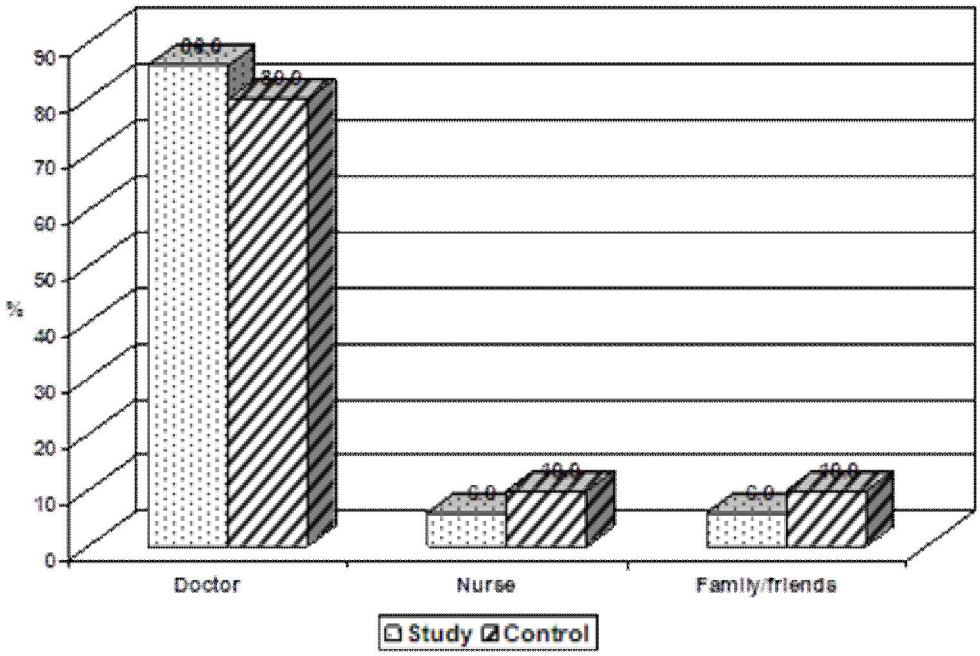


Figure (3): Percentage Distribution of the Studied Sample According to their Sources of Information for Instructions Received By Families in Study 1 and Control 1 Groups in the Pre-Intervention Stage *(Not Mutually Exclusive)*

Table (2): Number and Percentage Distribution of the Systems Assessment of Children (Study and Control Groups) As Observed By Nurses in the Pre-Intervention Stage

Adequate (60%+) assessment of systems	Patients				X^2 Test	p-value
	Study 1 (n=50)		Control 1 (n=50)			
	No.	%	No.	%		
Respiratory system	0	0.0	0	0.0	0.00	1.00
Score (%):						
Range	0.0-25.0		0.0-25.0			
Mean±SD	22.5±7.6		22.5±7.6		U=0.00	1.00
Cardiovascular system	0	0.0	0	0.0	0.00	1.00
Score (%):						
Range	16.7-25.0		8.3-33.3			
Mean±SD	16.9±1.2		25.2±8.5		U=30.88	<0.001*
Integumentary system	0	0.0	0	0.0	0.00	1.00
Score (%):						
Range	0.0-0.0		0.0-0.0			
Mean±SD	0.0±0.0		0.0±0.0		U=0.00	1.00
Fluid & electrolytes:	0	0.0	39	78.0	63.93	<0.001*
Score (%):						
Range	40.0-60.0		40.0-80.0			
Mean±SD	47.8±8.9		67.6±8.0		U=61.97	<0.001*
Neurological status:	0	0.0	0	0.0	0.00	1.00
Score (%):						
Range	0.0-16.7		0.0-16.7			
Mean±SD	0.7±3.3		0.3±2.4		U=0.34	0.56
Total assessment:	0	0.0	0	0.0	0.00	1.00
Score (%):						
Range	15.3-20.3		15.3-25.7			
Mean±SD	17.5±1.8		23.1±3.2		U=49.83	<0.001*

(*) Statistically significant at p<0.05 *(U) Mann-Whitney test*

Table (3): Number and Percentage Distribution of Nurses Ongoing Care Of Patients Children (Study and Control Groups) As Observed in the Pre-Intervention Stage

Nurses ongoing Care Practice (adequate: 60%+)	Patients				X^2 Test	p-value
	Study 1 (n=50)		Control 1 (n=50)			
	No.	%	No.	%		
Apply effective ventilation measure:	0	0.0	24	48.0	31.58	<0.001*
Score (%):						
Range	9.1-63.6		9.1-72.7			
Mean±SD	23.3±9.9		52.5±21.4		U=42.83	<0.001*
Fluid/electrolyte balance measurement:	50	100.0	50	100.0	0.00	1.00
Score (%):						
Range	71.4-85.7		71.4-71.4			
Mean±SD	71.7±2.0		71.4±0.0		U=0.00	1.00
Apply effective pain relief measure:	0	0.0	0	0.0	0.00	1.00
Score (%):						
Range	0.0-20.0		0.0-40.0			
Mean±SD	14.8±8.9		19.6±4.9		U=10.13	0.001*
Apply effective neurological stability measure	0	0.0	0	0.0	0.0	1.00
Score (%):						
Range	0.0-11.1		0.0-11.1			
Mean±SD	0.9±3.0		1.3±3.6		U=0.44	0.51
Total ongoing care:	0	0.0	0	0.0	0.00	1.00
Score (%):						
Range	20.0-41.5		24.7-41.5			
Mean±SD	27.7±3.5		36.2±5.4		U=44.91	<0.001*

(*) Statistically significant at p<0.05 *(U) Mann-Whitney test*

Table (4): Number and Percentage Distribution of Nursing Interventions Offered to Patients Children (Study and Control Groups) As Observed in the Pre-Intervention Stage

Components of nursing interventions offered (adequate: 60%+)	Patients				X^2 Test	p-value
	Study 1 (n=50)		Control 1 (n=50)			
	No.	%	No.	%		
Suctioning:	0	0.0	0	0.0	0.0	1.00
Score (%): Range	4.3-21.7		4.3-30.4			
Mean±SD	10.2±4.6		12.6±4.8		U=9.13	0.003*
Underwater seal:	0	0.0	0	0.0	0.00	1.00
Score (%): Range	11.1-33.3		16.7-38.9			
Mean±SD	16.7±4.6		28.1±6.7		U=50.75	<0.001*
Chest tube removal:	0	0.0	0	0.0	0.00	1.00
Score (%): Range	16.7-66.7		16.7-61.1			
Mean±SD	34.0±14.7		39.3±9.9		U=11.28	0.001*
Reading CVP:	0	0.0	0	0.0	0.00	1.00
Score (%): Range	27.3-54.5		27.3-54.5			
Mean±SD	32.0±9.9		30.9±8.4		U=0.14	0.71
Central venous catheter care:	0	0.0	0	0.0	0.00	1.00
Score (%): Range	11.1-38.9		11.1-44.4			
Mean±SD	24.8±8.8		34.7±7.0		U=29.88	<0.001*
Arterial pressure line care:	0	0.0	0	0.0	0.00	1.00
Score (%): Range	0.0-20.0		0.0-20.0			
Mean±SD	0.5±3.0		0.4±2.8		U=0.33	0.57
Arterial pressure line removal:	0	0.0	0	0.0	0.00	1.00
Score (%): Range	11.1-44.4		16.7-44.4			
Mean±SD	27.4±7.8		36.8±8.9		U=23.65	<0.001*
Urinary catheter care:	0	0.0	0	0.0	0.00	1.00
Score (%): Range	0.0-35.3		0.0-17.6			
Mean±SD	4.5±9.8		2.0±4.7		U=0.17	0.68
Urinary catheter removal:	0	0.0	0	0.0	0.00	1.00
Score (%): Range	16.7-58.3		25.0-66.7			
Mean±SD	28.7±10.3		44.7±11.1		U=34.80	<0.001*
Wound dressing:	0	0.0	0	0.0	0.00	1.00
Score (%): Range	0.0-33.3		0.0-33.3			
Mean±SD	10.0±7.8		23.9±11.6		U=29.15	<0.001*
Total care:	0	0.0	0	0.0	0.00	1.00
Score (%): Range	14.0-31.0		14.3-34.6			
Mean±SD	18.9±5.2		25.3±4.8		U=34.64	<0.001*

(*) Statistically significant at p<0.05 *(U) Mann-Whitney test*

Table (5): Number and Percentage Distribution of Nurses according to their Application of Ventilation Measures to Patients (Study and Control Groups) As Observed in the Pre-Intervention Stage

Nurses' application of ventilation measure (adequate (60%+)	Patients				X^2 Test	p-value
	Study 1 (n=50)		Control 1 (n=50)			
	No.	%	No.	%		
Apply effective ventilation measure:	0	0.0	0	0.0	0.0	1.00
Score (%):						
Range	20.0-36.7		20.0-36.7			
Mean±SD	26.8±4.5		30.6±4.3		U=16.71	<0.001*

(*) Statistically significant at p<0.05 *(U) Mann-Whitney test*

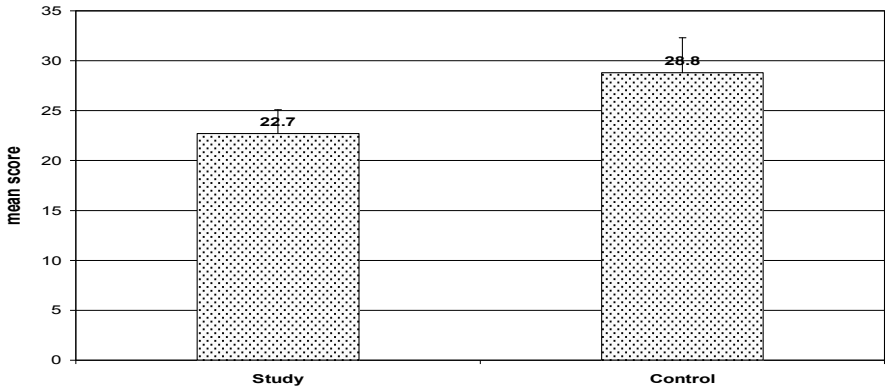
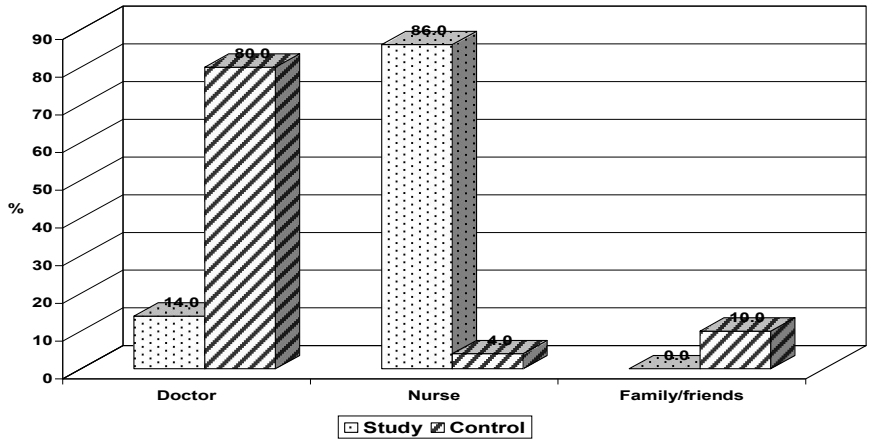


Figure (4): Total Nurses' Level of Interventions Provided to Patient's Children (Study and Control Groups) in the Pre-Intervention Stage

Table (6): Instructions Received By Patients in the Study and Control Groups in the Post-Intervention Stage

Instructions Received	Patients				X^2 Test	p-value
	Study-2 (n=50)		Control-2 (n=50)			
	No.	%	No.	%		
Indication for the operation	50	100.0	44	88.0	Fisher	0.03*
Objective of the operation	48	96.0	5	10.0	74.23	<0.001*
Advantages of the operation	48	96.0	12	24.0	54.00	<0.001*
Possible complications of the operation	48	96.0	0	0.0	92.31	<0.001*
Expected length of stay in the hospital	48	96.0	0	0.0	92.31	<0.001*
Postoperative care	48	96.0	0	0.0	92.31	<0.001*
Drugs	48	96.0	0	0.0	92.31	<0.001*
Diet	48	96.0	0	0.0	92.31	<0.001*
Rest and exercise	48	96.0	0	0.0	92.31	<0.001*
Work	48	96.0	0	0.0	92.31	<0.001*
Follow-up after operation	48	96.0	0	0.0	92.31	<0.001*
Warning signs	48	96.0	0	0.0	92.31	<0.001*
Action in emergency situation	48	96.0	0	0.0	92.31	<0.001*
Received instructions	50	100.0	44	88.0	Fisher	0.03*
No. of instructions (%):						
Range	1-13		0-3			
Mean±SD	12.5±0.3		1.2±0.1		U=79.76	<0.001*

(*) Statistically significant at p<0.05 *(U) Mann-Whitney test*



(*) Statistically significant at p<0.05

Figure (5): Sources of Information for Instructions Received by Patient's Children and their Families in the Post-Intervention Stage Study-2 and Control-2 Groups (Not Mutually Exclusive)

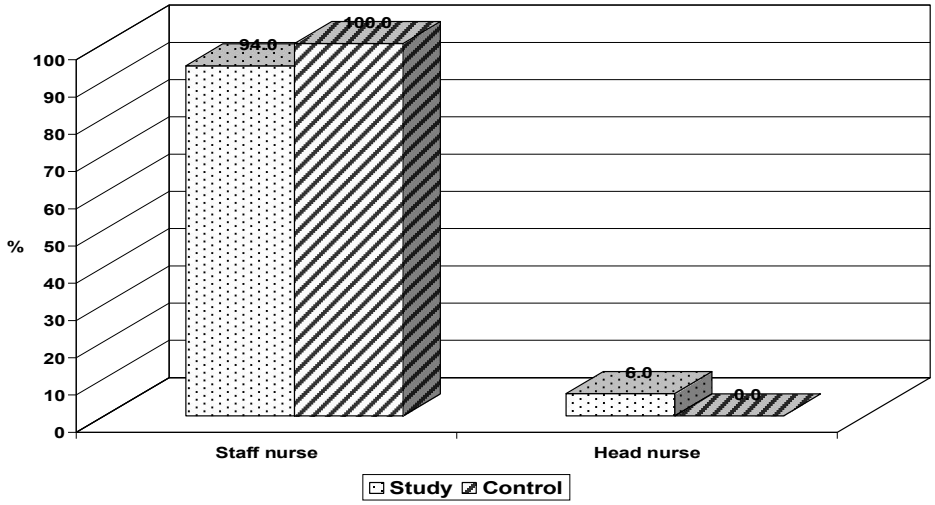


Figure (6): Distribution of Nurses' Job Positions Sharing in Nursing Care of Children in the Post-Intervention Samples

Table (7): Number and Percentage Distribution of Nurses according to their Care provided to Children in the Study and Control Groups in the Post-Intervention Stage

Adequate (60%+) assessment of systems	Patients				X^2 Test	p-value
	Study-2 (n=50)		Control-2 (n=50)			
	No.	%	No.	%		
Respiratory system	50	100.0	0	0.0	100.00	<0.001*
Cardiovascular system	48	96.0	0	0.0	92.31	<0.001*
Integumentary system	47	94.0	0	0.0	88.68	<0.001*
Fluid & electrolytes	50	100.0	34	68.0	19.05	<0.001*
Neurological status	48	96.0	0	0.0	92.31	<0.001*
Total assessment	48	96.0	0	0.0	92.31	<0.001*
Effective ventilation	50	100.0	25	50.0	33.33	<0.001*
Fluid/electrolyte balance	50	100.0	50	100.0	0.00	1.00
Pain relief	48	96.0	0	0.0	92.31	<0.001*
Neurological stability	48	96.0	0	0.0	92.31	<0.001*
Total ongoing care	48	96.0	0	0.0	92.31	<0.001*
Suctioning	48	96.0	0	0.0	92.31	<0.001*
Underwater seal	48	96.0	0	0.0	92.31	<0.001*
Chest tube removal	48	96.0	0	0.0	92.31	<0.001*
Reading CVP	48	96.0	0	0.0	92.31	<0.001*
Central venous catheter care	48	96.0	0	0.0	92.31	<0.001*
Arterial pressure line care	48	96.0	0	0.0	92.31	<0.001*
Arterial pressure line removal	48	96.0	0	0.0	92.31	<0.001*
Urinary catheter care	48	96.0	0	0.0	92.31	<0.001*
Urinary catheter removal	48	96.0	0	0.0	92.31	<0.001*
Wound dressing	48	96.0	0	0.0	92.31	<0.001*
Total care	48	96.0	0	0.0	92.31	<0.001*
Ongoing ventilator care	48	96.0	0	0.0	92.31	<0.001*
Total observation	48	96.0	0	0.0	92.31	<0.001*

Table (8): Number and Percentage Distribution of Nurses according to their Care provided to Children in the Study Group at the Pre- and Post-Intervention Phases

Adequate (60%+)	Time				X^2 Test	p-value
	Pre (n=50)		Post (n=50)			
	No.	%	No.	%		
Assessment	0	0.0	48	96.0	92.31	<0.001*
Ongoing care	0	0.0	48	96.0	92.31	<0.001*
Nursing care	0	0.0	48	96.0	92.31	<0.001*
Ongoing ventilator care	0	0.0	48	96.0	92.31	<0.001*

(*) Statistically significant at p<0.05

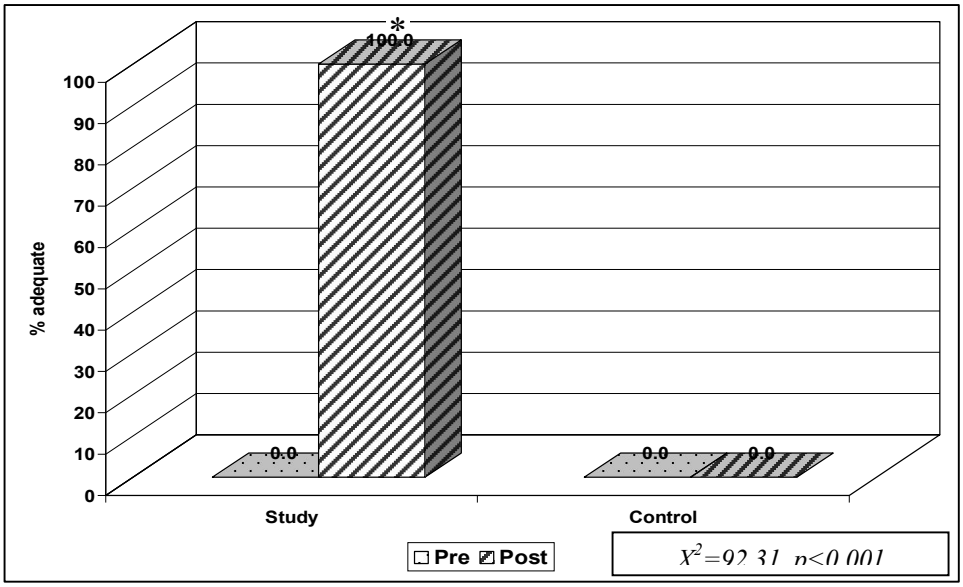


Figure (7): Total Care Provided To Children by Nurses in the Study and Control Groups at the Pre- and Post-Intervention Phases

Table (9): Number and Percentage Distribution of Clinical Pathway Team Members according to their Job and Experience

	Pre	
	No.	%
Job:		
Resident physician	6	10.7
Nurse	50	89.3
Experience years:		
Range	0.0-14.0	
Mean±SD	1.8±4.2	

Table (10): Number and Percentage Distribution of Clinical Pathway Team Members according to their Knowledge about Clinical Pathway before and after Intervention

Knowledge about clinical pathway:	Stage				X^2 Test	p-value
	Pre (n=56)		Post (n=56)			
	No.	%	No.	%		
Definition	0	0.0	56	100.0	112.00	<0.001*
Utility	0	0.0	56	100.0	112.00	<0.001*
Team	0	0.0	56	100.0	112.00	<0.001*
Objectives	0	0.0	56	100.0	112.00	<0.001*
Steps	0	0.0	56	100.0	112.00	<0.001*
Total						
Satisfactory (60%+)	0	0.0	56	100.0		
Unsatisfactory (<60%)	56	100.0	0	0.0	112.00	<0.001*

(*) Statistically significant at p<0.05

Table (11): Percentages of Variance of Application of Clinical Pathway By Nurses

Days	Done	Not done due to			
		Nurse	Physician	Supplies	System
1	26.0	38.0	12.0	12.0	12.0
2	18.0	40.0	14.0	14.0	14.0
3	12.0	50.0	12.0	13.0	13.0
4	12.0	66.0	6.0	8.0	8.0
5	2.0	88.0	2.0	4.0	4.0

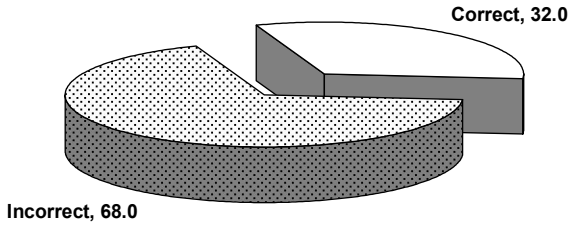


Figure (8): Total Variance of Application of Clinical Pathway by Nurses

Table (12): Number and Percentage Distribution of Nurses' Knowledge about Heart Disease in the Study and Control Groups (Pre-Intervention)

Satisfactory (60%) Knowledge heart disease	Group				X^2 Test	p-value
	Study (n=50)		Control (n=50)			
	No.	%	No.	%		
Definition	2	4.0	0	0.0	Fisher	0.49
Risk factors	42	84.0	41	82.0	0.07	0.79
Heart surgery	29	58.0	26	52.0	0.36	0.55
Nursing role in Heart surgery	27	54.0	11	22.0	10.87	0.001*
Measurements	38	76.0	34	68.0	0.79	0.37
Medications	33	66.0	24	48.0	3.30	0.07
Ventilator	16	32.0	8	16.0	3.51	0.06
Lab work	9	18.0	9	18.0	0.00	1.00
Wound dressing	2	4.0	0	0.0	Fisher	0.49

(*) Statistically significant at p<0.05

Table (13): Number and Percentage Distribution of Nurses' Knowledge about Heart Diseases in the Study and Control Groups Post-Intervention

Satisfactory (60%) Knowledge heart diseases	Group				X^2 Test	p-value
	Study (n=50)		Control (n=50)			
	No.	%	No.	%		
Definition	48	96.0	0	0.0	92.31	<0.001*
Risk factors	50	100.0	42	84.0	Fisher	0.006*
Heart surgery	50	100.0	29	58.0	26.58	<0.001*
Nursing role in Heart surgery	48	96.0	10	20.0	59.28	<0.001*
Measurements	50	100.0	32	64.0	21.95	<0.001*
Medications	48	96.0	23	46.0	30.35	<0.001*
Ventilator	49	98.0	9	18.0	65.68	<0.001*
Lab work	50	100.0	10	20.0	66.67	<0.001*
Wound dressing	44	88.0	0	0.0	78.57	<0.001*

(*) Statistically significant at p<0.05

4. Discussion

Prolonged intensive care unit (ICU) length of stay (LOS) following cardiothoracic surgery is a source of great expense to the health care system. Increased costs resulting from the consumption of excess ICU resources emphasize the importance of being able to identify those patients at risk of experiencing prolonged LOS in advance of the planned intervention ***(Herman et al., 2009)***.

This study aims to compare between the traditional care plan method and clinical pathway for management of postoperative children undergoing cardiothoracic surgery. The study was done on an intervention and a control group of children having similar socio-demographic characteristics in the pre-intervention samples.

Regarding socio-demographic data of children undergoing cardiothoracic surgery the finding showed that the minimum age was (3) and maximum age was (12), the mean age was (5.17) as reported by ***Rothrock and Smith (2003)***, in united states, about one third of chronic heart disease children become critically ill in the first year, another third developed chronic illness in early childhood and had cardiac disease.

The current study also revealed that the sex of children was (53.3%) male and (46.7%) female as **Nasre, Ali, and Shawky, (2001)**reported that, the congenital heart disease as a whale, occurs with an equal frequency in males and females but some lesions as aortic stenosis, coarctation of the aorta are more common in males, while patent ductus arterious and atrial septal defect are more common in females.

Regarding to children's disease data. The study showed that the time of disease was from birth (43.3%). ***Amin (2009)*** stated that, the currently nearly 25% of children undergoing open heart surgery are under a month of age and nearly 70% are under 1 year of age. The finding showed that, child disease diagnosis was the majority for VSD (50%) while ASD (20%) and TOF (16.6%) as ***Ahmed, (2012)*** stated that about half of the studied sample have VSD.

As regarding to signs and symptoms of disease as seen in figure 2, the current study revealed that, the highest percentage of signs and symptoms of disease was tachycardia (90%), tachypnea (93.3%), difficult in breathing (66.7%), dyspnea (76.7%), change of skin color (cyanosis) (60%), clubbing nails (13.3%). The two groups of the present study had also almost equal means of length of hospital stay in the pre-intervention samples, mostly less than ten days. This factor is also of importance in assessing and comparing study variables between the two groups as the length of stay may reflect the outcome of the children and can influence his/her satisfaction with the care provided. In congruence with this view, ***Daly et al. (2005)*** suggest that patients who had a prolonged stay in an ICU are at high risk for hospital readmission, particularly within the first two months following hospital discharge.

The present study findings revealed a major deficiency regarding the instructions given to children and their families in the pre-intervention samples. Although most of them were informed about indication for the operation, very few or none of them had any of the thirteen instructions inquired about. On average, only about one of these instructions was reported to be received. This rather alarming finding implies that the health care team members do not perform their important role related to patient education. Moreover, the finding is against the principles of hospitalized child rights regarding the right to information. In agreement with these findings, ***Edward et al. (2010)*** reported that patients received fewer recommendations for open heart surgery than were indicated.

As demonstrated by the results of the current study, this deficiency in patient education role was mainly related to nurses rather than physicians. In fact, the findings revealed that physicians were the major source in information and instructions in both groups, while the role of the nurse was minimal. In congruence with the present study finding of deficient nurses' knowledge in control and study group related to heart disease, which was particularly evident in the areas of health education, ***Sanad (2006)*** reported deficiency in nurses' knowledge related to cardiac surgery care in the intensive care units of Ain Shams University hospitals. This was attributed to lack of nursing conferences, unavailability of procedures book, and lack of supervision.

The nurses who were observed while providing care to patients in the study and control groups of the pre-intervention samples were similar to guarantee a fair comparison between the two groups. The results of observation of their performance of patient assessment point to a major deficiency, where none of them, in either of the two groups, had adequate performance. The assessment of fluids and electrolytes balance was the only item adequately performed by most nurses in the control group.

Observation of the nurses' performance of ongoing care of children in the pre-intervention samples in the study and control groups was no better than in patient child assessment. Thus, none of them had adequate performance of this ongoing care, except for the care related to fluids and electrolytes, which was adequately performed by all nurses in both groups. The finding confirms the previous explanation of the presumed importance of fluids and electrolytes in nurses' minds and perceptions, so that they concentrate all their nursing care in this item. These findings underscore the importance of implementation

of clinical pathway to improve the deficient performance of these nurses. The same deficient performance of nurses in the pre-intervention samples was noticed regarding the nursing care and ventilator ongoing care provided to children. The present study findings indicated that none of them nurses had adequate performance of any of the tasks. It is most certainly due to lack of knowledge and negative attitude regarding these tasks. The workload and shortage of staff could have a role, but do not justify this poor level of performance. In agreement with this, ***Kavari (2006)*** and ***Murphy et al. (2009)*** reported that limited resources and high workloads may underlie deficient performance among health care providers.

The present study intervention was also associated with better patient child and their family's education. In the post-intervention instruction for study group was significantly higher, compared to the control group. These findings imply that the intervention improved education activities for the children and their families, and this could be a mechanism underlying the improvement in child's' outcomes. In congruence with this, ***Rowan-Sza, et al., (2007)*** emphasized that enhanced communication between caregivers from the acute care setting is essential.

The improvement in patient child education activities revealed in the current study was not only in the provision of instructions to children, but also in the source of information. The findings indicated that still physicians were the major source of information in the control group, while nurses were the main sources in the study group. Therefore, the intervention was associated with an improvement in nurse's essential role in patient education. In line with this, ***Canyon and Meshgin (2008)*** highlighted the importance of multidisciplinary approach in the management of cardiac patients.

Concerning the performance nurses tasks at the post-intervention phase; the present study demonstrated significant improvements only among nurses in the study group. It was found that nurses in the control group had similar performance as in the pre-intervention phase, where none had adequate performance, except for some items related to fluids and electrolytes. On the contrary, the majority of the nurses in the study group had adequate performance of assessment tasks, which significantly higher than those in the control group. Similar findings were also revealed in all areas of observation. These results confirm the positive effect of the intervention on nurses' performance, which was positively reflected on child's outcomes. Also, they indicate that training and educational interventions can improve the performance of nurses**. (Sanad, 2012).**

This study was highly supported by the similarly of - ***Burns et al. (2003)*** tested an intervention in which evidence-based clinical pathway was implemented in mechanical ventilation. Compared with pre-intervention, patients managed by using the pathway had a significant reduction in median days of mechanical ventilation, ICU length of stay and hospital length of stay.

The present study has also assessed nurses' knowledge regarding heart diseases (HD) in pediatric and tested the effect of the intervention on the knowledge. Nurses in the study and control groups had similar socio-demographic and work characteristics. This was essential to have comparable group where the effect of the intervention could be measured without bias or confounding.

Nurses' knowledge about heart diseases (HD) in pediatric was unsatisfactory in the study and control groups before the intervention. The only exceptions were related to risk factors and measurements. It was also found that nurses in the study group had significantly better knowledge about the nursing role in post care open heart surgery.. The finding is accordance with ***Sanad (2006),*** who has reported similar deficiency in nurses' knowledge related to open heart surgery care in the intensive care units of Ain Shams University hospitals. This was attributed to lack of nursing conferences, unavailability of procedures book, and lack of supervision.

It shows from the current study that there was statistically significant improvement in the percentages of satisfactory knowledge in the all study group, while no change was noticed in the control group. **(Sanad, 2012).**

Therefore, the current study included increasing physicians' awareness about the clinical pathway. This led to significant improvement of their knowledge at post-intervention phase, where all of them had correct knowledge in all areas. Physicians' understanding would be an important factor in the success of the program in improving nurses' performance, and consequently improved children's outcomes. In agreement with this, ***Yates et al. (2007)*** multi-disciplinary team work success lies in the clarity of professional roles, shared understanding of roles, mutual respect and valuing of others' roles as well as trust in the performance of others in agreed roles.

The implementation of the clinical pathway by nurses in the study group was also monitored and evaluated. Their application of the pathway was high at the start of the patient stay in the unit. However, it declined from day one to day five. Overall, only about one-third of the nurses were judged to have applied the pathway correctly. The lack of application of the pathway steps for reasons beyond the responsibility of the nurse were not counted as incorrect application.

A number of factors were observed by the researcher during implementation of the pathway that may explain nurses' decreasing performance. The first factor is the lack of resources. For example, during the suction or dressing procedure, the nurse should use sterile gloves; however, in real life situation she could not because of the limited numbers supplied to her. In the same perspective, ***Sanad, 2012,*** has indicated that not only scientific knowledge but also experience could affect the overall quality performance and lack of in-services education.

The second factor underlying decreasing nurses' performance was related to system or hospital rules and regulations. For example the rules clarifying nursing and medical roles may have some deficiencies.

The third factor is related to both resources and rules. In this respect, from the analysis of the variance form, the researcher was forced to modify the clinical pathway regarding blood investigations to be done on alternate days instead of every day because of the shortage of hospital budget allocated for this. The fourth factor was related to physician's role. As a member of the team, the physician had certain assigned tasks in the implementation of the clinical pathway. The present study findings are of great importance since the success shown by the implementation of the intervention in child's outcomes was achieved with application of the clinical pathways by the nurses and it was increase its effect by work in a team. And the compliance and obligate the nursing staff to apply clinical pathway will help in such application

Conclusion

In the light of the current study it can be concluded that, the implementation of the clinical pathway regarding care of postoperative children undergoing cardiothoracic surgery had a positive effect on the improvements of both nurses and resident physicians' knowledge and performance comparing the traditional care plan method which confirmed the research hypothesis. In addition, there were statistical significant differences between nurses' knowledge and performance pre and post implementation of the clinical pathway were observed; all the areas were adequately performed by almost all nurses for almost all children in the study group.

Recommendations:

In the light of the main study findings, the following recommendations are proposed.

- The developed clinical pathway must be implemented in all the units of pediatric care settings for confirmation and improvement. Thereafter, it could be generalized to similar settings.
- In-service training programs should be given to improve knowledge among post-operative cardiac surgery care nurses.
- Such training programs should be tailored to nurses' needs that must be identified by assessment surveys aiming at identification of common errors and deficiencies.
- The in-service training programs regarding application pathway should also take into account the results of assessment of child's needs, which might vary from one setting to the other.

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