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Effect of an Infection Control Competency Based Protocol on the Occurrence of Blood Borne Infection in Pediatric Hemodialysis Unit at Minofiya University Hospital

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ABSTRACT: Chronic hemodialysis children are at high risk for infection. So, there is an urgent need for an infection control program to be applied in hemodialysis units. The aims of this study were to identify basic cognitive, psychomotor and attitudinal in infection control competencies of nurses in hemodialysis units, set an infection control protocol for preventing infection in hemodialysis unit, and develop a competency based health education program for nurses about infection control at hemodialysis unit and evaluate the effect of a competency based health education program on nurses competencies related to infection control and occurrence of blood born infection. A quasi-experimental research design was used with a sample of 25 nurses and 15 children were investigated for blood born infection. at Minofiya University Hospitals. Tools were interview questionnaire, observation checklists and laboratory records. The results showed that, there were statistical significant differences between pre test, post test and retention test for nurses' knowledge, skills and attitudes. Conclusion, this study concluded that infection control competency based protocol improved competencies of hemodialysis nurses regarding infection control and blood born infection. So, it was recommended that infection control programs should be performed to upgrade nurses' knowledge and performance for infection control.

KEYWORDS: Chronic Renal Failure, Hemodialysis, Competency and Infection Control

ORIGINAL ARTICLE

INTRODUCION

Hemodialysis is the therapy used most often among patients with end-stage renal disease Hafeez et al. (2002) Worldwide, slightly more than 30 people in every 100,000 develop kidney failure each year and the annual rate of children who develop chronic renal failure is 1 or 2 new cases in every 100,000 children. The risk increases steadily with age. National Kidney & Urologic Diseases Information Clearinghouse (2010). Chronic hemodialysis children are at high risk for infection because the process of hemodialysis requires vascular access for prolonged periods. Furthermore, hemodialysis children are immunosuppressed, which increases their susceptibility to infection. Besides, they require frequent hospitalizations and surgery, which increases their opportunities for exposure to nosocomial infections Higgins & Evans, (2001).

Infections accompanied with hemodialysis are the second leading cause of mortality among children with end-stage renal disease. Many of these infections are due to sepsis, which arises from the vascular access site. It accounts for almost 11% of mortality in hemodialysis children. Also, there is a high risk of indirect and direct transmission of infectious agents in chronic hemodialysis. So, competency based infection control procedures should be established in a competency basis at dialysis units Arduino and Tokars, (2005); Yanai, (2006).

Infectious complications of hemodialysis include bacterial infections caused by contaminated water, equipment, vascular access infections, and blood borne viruses (primarily the hepatitis B and C viruses). Standard precautions with additional measures recommended specifically for dialysis centers will prevent transmission of bacteria and viruses from patient to patient. In addition, preventing the transmission of hepatitis B virus infection requires vaccination of susceptible patients and staff, avoiding dialyzer reuse, and use of a dedicated room, dialysis machine, and well prepared staff members when treating patients chronically infected with these viruses Tokars et al. (2001)

Any healthcare setting has issues related to infectious diseases and the safety of both patients and staff, but the dialysis setting has its own concerns. Renal care children may carry blood borne pathogens, and therefore pose a risk to the healthcare workers treating them and to the other patients being treated in the dialysis center. Balter (2001), Dix (2007), Competence combines knowledge, skills, application and judgment which are all affected by each other and influenced by our attitudes and

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values. Competencies are statements of performance combining the elements of competence, which provide the public and employers with details of expectations about their role. In addition to being accepted as occupational standards, they provide a framework for developing skills and a foundation for valid assessment Robert, (2004) Nurses need to learn and know the techniques that enhance prevention of cross infection, in which implementation makes a difference and how to achieve them practically. Nurses are directly and indirectly linked with the patient's care and outcome in relation to acquisition of infection. Certain practices and procedures if practiced by healthcare professionals are mastered and used competently can reduce the risk of infection for many children Storr et al, (2005). Because there are limited pediatric studies in this field, So, development of nurses' competencies is essential for providing high quality of care and reducing the risk of blood born infection Stone et al., (2007)

The aims of this study were to identify basic infection control skills and competencies of nurses in hemodialysis units, set an infection control protocol for preventing infection in hemodialysis unit, develop a competency based health education program for nurses about infection control at hemodialysis unit, and evaluate the effect of a competency based health education program on nurses competencies related to infection control on the occurrence of blood borne infection.

Hypothesis

Infection Control Competency based protocol will improve competencies of hemodialysis nurses regarding infection control and reduce the occurrence of blood born infection**.**

MATERIALSAND METHODS

1- Materials

A) Research design:-

A quasi-experimental research design was used

B) Settings:-

This study was conducted in the Pediatric Hemodialysis Unit at Minofiya University Hospital. The unit consists of one large room. The room contains 8 hemodialysis machines. There is one sink with water tap at the unit.

C) Sample:-

1-A convenient sample of all nurses working in Hemodialysis Unit (n= 25) were included. They consisted of 16 high qualified Bachelorette degree nurse and 9 secondary diploma nurses.

2-purpusive sample including All children (n= 15) receiving hemodialysis sessions over the period of 6 months. All of them were receiving 3 hemodialysis session/ week. Each session lasted from 3-4 hours

D) Tools of the study:-

Two tools were utilized for data collection.

Tool one: Infection Control Precautions structured questionnaire, it is used to assess nurses' knowledge about infection control in hemodialysis unit. The tool was adopted from the National Health Service (2004) and Ebrahem, (2009). Afterwards it was modified by the researcher. It contained 8 questions about nosocomial infection and 23 questions about standard precautions for infection control in hemodialysis unit. It was divided into two parts.

Part one: Sociodemographic data of the nurses. It was developed by the researcher. It included nurses' name, age, sex, educational level, years of experience, attendance of any training programs for infection control and knowledge about hospital policy

Part two: Nurses' knowledge about infection control precautions. This part was divided into two sections.

Section one: Nosocomial Infection Knowledge. It included 8 questions about definition of infection, routes of transmitting infection, infectious diseases that can be transmitted, personnel prone to infection in hemodialysis unit, definition of isolation; cases in need for isolation, caring for isolated children, and blood borne infection each question scored by know (>30) or Don't know(<30)

Section two: Standard Precautions for Infection Control in Hemodialysis Unit. It included 23 questions about hand washing, using of protective measures, methods of disinfecting medical devices; disinfection of thermometer, stethoscope, and sphygmomanometer cuff, caring for external services of hemodialysis machine, internal disinfection of hemodialysis machine, care for vascular access, cleaning of contaminated surfaces , care for contaminated linens, care for sharp objects, waste disposal, spilled blood and hemodialysis environment, ideal characteristics of hemodialysis unit and monitoring of water quality.

Total scores were 136 points: each question scored by know (>68) or Don't know (<68)

Tool 2: Observation sheets they were divided into two parts

Part one: Infection control Precaution Observational Checklist.

It was adopted from Ebrahem (2009) and modified by the researcher. It contained three sections

Section one: It contained biosocial data of children. It contained child's name, age, sex, education, duration of dialysis, number of dialysis per week, and results of blood borne virus.

Section two: Hemodialysis procedure steps. It was divided into three parts.

1. Nurses' Application of infection control precautions before hemodialysis procedure. It included wearing overshoes, hand washing, wearing mask and goggles, wearing sterile gowns, preparation and placement equipments on special clean table, taking children's vital signs, and children's preparation for procedure.

Each correct steps of performance done correctly was given 3 points, 2 points if it performed incorrectly and 1 point if not performed. Total scores were 150 marks each skill scored by good performance (>75) or poor performance (<75)

2-Nurses Application of infection control precautions during the procedure. It contained 3 items for infection control precautions during procedure

- Starting dialysis. It contained inserting needles, discarding soiled materials in plastic bags, removing gloves, and hand washing.
- During dialysis. It included routine hand washing, wearing/changing gloves, checking children's vital signs, giving injection, and discarding needles in sharp container.

Terminating dialysis. It included hand washing, wearing sterile gloves, applying sterile dressings to shunt site, and checking children's vital signs. Total scores were 96 points. each question scored by good performed (>48) or poor performed (<48)

3 Nurses' Application of infection control precautions after the procedure. It contained 7 statements about infection control precautions after procedure including disinfection and rinsing hemodialysis machine, handling linen, care of non disposable equipments, removing gowns, removing gloves, washing hands, and removing masks and face shields .Total scores were 108 points. each skill scored good performance (>54) or poor performance (<54).

Section three: Nurses' practices in the maintenance of hemodialysis environment. It assessed nurses' observed attitudes regarding infection control precautions in hemodialysis unit. It was divided into two parts.

1. Treatment area: It contained promptly cleansing up spilled blood, dialyzing the patient with HBV, HCV or human immunodeficiency virus in a separate room, using common carts in the patient's treatment area to prepare or give out medications, using air condition, keeping doors closed, closing windows, and after treatment cleaning surfaces at station

Healthy behaviors: It contained eating in treatment area, Smoking in treatment area, applying cosmetics or lip balm or handling contact lenses in treatment area, storing food and drinks in refrigerator, freezer, shelves, cabinets, or counters where blood or other body fluid may be resent, and replacing uniforms contaminated with blood immediately. Total scores were 36 points. each skill scored as good performance (>18) or poor performance (<18)

Part two: Laboratory investigation record. It included an investigation record for (HBV, HCV, and HIV).

MATERIAL AND METHOD

1-Written Permission:

An official permission to carry out the study was obtained from the director of Minofiya University Hospital, head of hemodialysis unit, and the head nurse of the hospital after submitting an official letter from the Dean of the Faculty of Nursing at Minofiya University explaining the purpose of the study and methods of data collection.

2-**Tool Development**:

Tools were developed by the researcher for data collection after a review of past and current literature, local and international related literature using books, articles, periodicals and magazines. Then, the tools were submitted to a jury of two pediatric nursing experts and one pediatrician for the validity purpose. Tools reliability was tested by Cronbach's co-efficiency alpha test for the structures interview questionnaire (r= 0.77) and for infection control observation checklist (r= 0.78).

3- Protection of Human Right:

A consent was orally obtained from nurses before participation in the study after explaining that the collected data was used only for study purposes, Confidentiality and privacy were assured.

4-Pilot Study

A Pilot study was carried on 3 nurses after the tools were developed and before starting the data collection to test the clarity, applicability and reliability. No modifications were needed for the tools. So, pilot study sample was included in the sample.

5- Data Collection

Data collection for this study was conducted for a period of 6 months extending from the first of May 2011 to the end of October 2011.

A. Assessment Phase: A questionnaire was administered to collect baseline data about nurses' knowledge related to infection control, Afterwards; nurses' infection control practices were assessed to collect data about nurses' performance in infection control.

B. Areas of weakness in knowledge and practices were identified and general program objectives were set as follows.

The following general objectives were set:

1. To recognize general infection Control precautions implemented by nurses
2. To provide care for children on hemodialysis accurately

C. Planning Phase: The researcher planned an infection control competency based protocol after a review of literature. This protocol included number of sessions, contents and methods of teaching. This protocol was revised by a specialist in infection control (physician)

responsible for infection control in hospitals (Ministry of health, Minofiya sector).

D. Implementation Phase:

Theprogram was implemented in the hemodialysis unit at Minofiya University. The program was implemented for seven days. Nurses' educational and training needs (deficient knowledge and practices) were assessed in order to be met.

A booklet was designed and included a teaching module. It contained definition of infection, causes of infection, routes of infection transmission, normal protective barriers in the body, universal precautions and infection control in hemodialysis units, ideal characteristics of hemodialysis unit and clinical infection control skills for hemodialysis.

Seven teaching sessions were conducted focusing on information included in the booklet. Each session contained a number of eight nurses for a period of 30- 45 minutes. Teaching methods used were discussion, lecture, demonstration and re-demonstration. Teaching activities were videos and power point presentation.

E. Evaluation Phase:

Nurses' knowledge, skills and observed attitudes were evaluated to determine the extent of acquired knowledge and practices. Evaluations were done pre and post implementation of the program. An immediate follow up for evaluation of nurses' knowledge and practices was conducted immediately after the health education program. Another follow up was conducted three months later. A blood borne infection assessment for hemodialysis children was done once before program and immediately after the program implementation,

6- Data analysis:-

Data was coded and transformed into specially designed form to be suitable for computer data entry process. Data was entered and analyzed by using SPSS (Statistical Package for Social Science) statistical package version 15. Graphics were done using Excel program. Scores were used to evaluate nurses' attitude, performance and their knowledge about infection control

Quantitative data were presented by Descriptive measures in the form of frequency, percentage, arithmetic mean ($\bar{X}$) and standard deviation (SD). It was analyzed by chi-square (χ^2) test. Fisher Exact test was used for cell values less than 5 Level of significance was set as P value <0.05 for all. Statistical tests Kruskal Wallis test was used for comparison between two means.

Limitations of the Study

- Lack of supplies (e.g. mask, gown, eye goggles) and resources (e.g. one sink in the unit).
- Attitude change takes longer time and needs frequent continuous monitoring.

RESULTS

Table 1 shows distribution of nurses and children in the study according to their biosocial characteristics $\bar{X}$±SD of nurses' and children age were 25.92±4.84. and 14.07± 2.99 .Approximately two thirds of nurses (64%) had bachelor degree in nursing .with four years of experience in nursing practice $\bar{X}$ + SD was 6.6 ± 3.96. and4.26 ± 4.36 years of experience in hemodialysis unit,. Meanwhile, more than half of nurses (60%) spent 6-12 hours working in hemodialysis unit, didn't attend any infection control training program and 80 % of them didn't have knowledge about hospital policy of infection control. Regarding to the duration of dialysis, the mean and standard deviation was 3 ± 1.53. In relation to blood borne virus about three quarters of children had negative results for blood borne virus (71.4%).

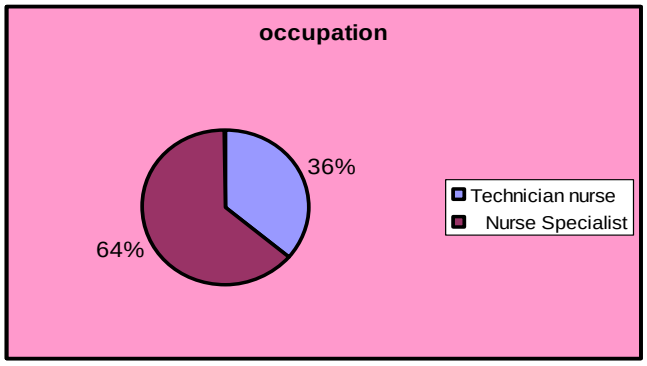


Figure 1: Nurses' occupation

Figure 1. Represents occupation of nurses working in hemodialysis unit. More than half of nurses (64%) were nurse specialists (had bachelor degree).

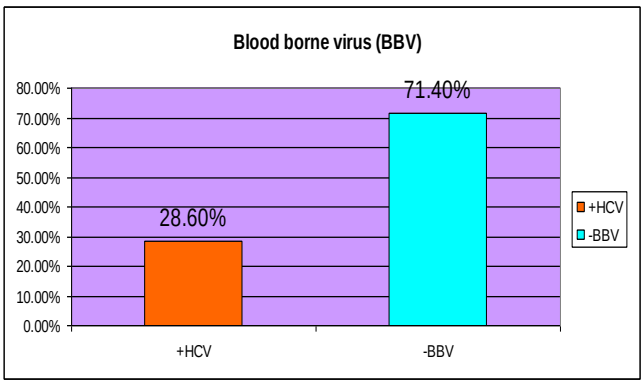


Figure 2. Existing blood borne viruses (BBV)

Figure (2) Represents existing of blood borne viruses in children receiving hemodialysis. It illustrated that about three quarter of children (71.40%) had negative results for blood borne virus, and (29, 60%) of children have blood born viruses

Table 1. Distribution of studied nurses according to their biosocial characteristics

Biosocial characteristics of studied nurses	No	%
Age		
$\bar{X}$ + SD	25.92 + 4.84	
Education level		
Diploma	9	36.0
Bachelor	16	64.0
Years of experience in nursing.		
$\bar{X}$ + SD	6.6 + 3.96	
Years of experience in hemodialysis unit.		
$\bar{X}$ + SD	4.26 + 4.36	
Hours spent in HD unit		
< 6h	5	20.0
6-12h	15	60.0
> 12h	5	20.0
Attendance of Infection Control training program.		
Yes	10	40.0
No	15	60.0
Knowledge about hospital policy of infection control.		
Know	20	80.0
Don't know	5	20.0
Age in years		
$\bar{X}$ + SD	14.07 $\pm$ 2.99	
Range	8-19	
Sex		
Male	6	42.9
Female	8	57.1
Duration of hemodialysis		
$\bar{X}$ + SD	3 + 1.53	
Range in years	1-7	
Blood borne virus		
+HCV	4	28.6
-BBV	10	71.4

Table 2 shows comparison between knowledge of nurses about nosocomial infection, isolation and blood-borne viruses at pre test, post test and retention test .It revealed that nurses had higher knowledge about nosocomial infection, Isolation and Blood-borne Viruses on post test and retention test than on pre test. Therefore there were statistical significance differences ($P<0.05$)

Table 3 Comparison between knowledge of nurses about disinfection of used equipment, hemodialysis machine and care of vascular access site on pre-test and post-test and retention test. There were an improvement in knowledge of nurses about disinfection of used equipment in hemodialysis unit, hemodialysis machine and caring for vascular access on post test and retention test than on pre test. For this reason there were statistical significance differences $P<0.05$

Table 4 Show Comparison between pre, post and retention test regarding knowledge of nurses about disinfecting and caring for hemodialysis environment. The nurses had higher level of knowledge about disinfection and care for hemodialysis environment on post test and retention test than on pre test. Therefore, there were statistical significant differences at 5% and 1% levels of statistical significance.

Table 5 shows comparison between knowledge of nurses about nosocomial infection and standard precautions according to their level of education. Although, it was obvious that the percentage of nurses with bachelor degree who had knowledge about nosocomial infection and standard precautions for infection control was higher than diploma degree nurses, there was no significant difference between them at pre-test, post-test and retention test.

Table 2. Comparison between knowledge of nurses at hemodialysis unit about nosocomial infection, child Isolation and Blood-borne Viruses on pre test, post test and retention test

Nurses knowledge about nosocomial infection, child isolation and blood born viruses	Pre test (n=25)		Post test (n=25)		Retention test (n=25)		Fisher exact test X^2
	No	%	No	%	No	%	
Definition of infection							
Don't know	8	32.0	3	12.0	3	12.0	23.32**
Incomplete	17	68.0	8	32.0	17	68.0	
Complete	0	0.0	14	56.0	5	20.0	
Routes of transmission in hemodialysis unit							
Don't know	8	32.0	4	16.0	2	8.0	11.49*
Incomplete	17	68.0	14	56.0	19	76.0	
Complete	0	0.0	7	28.0	4	16.0	
Types of Infectious transmitted in hemodialysis unit	10	40.0	0	0.0	0	0.0	
Don't know	15	60.0	10	40.0	13	52.0	35.0**
Incomplete	0	0.0	15	60.0	12	48.0	
Complete							
Personnel prone to infection in hemodialysis unit	6	24.0	0	0.0	0	0.0	
Don't know	19	76.0	17	68.0	19	76.0	19.57**
Incomplete	0	0.0	8	32.0	6	24.0	
Complete							
Definition of isolation							
Don't know	9	36.0	0	0.0	4	16.0	19.64**
Incomplete answer	15	36.0	12	48.0	13	52.0	
Complete answer	1	8.0	13	52.0	8	32.0	
Cases that require isolation							
Don't know	8	32.0	0	0.0	0	0.0	22.39**
Incomplete answer	15	60.0	14	56.0	15	60.0	
Complete answer	2	8.0	11	44.0	10	40.0	
Care for isolated child							
Don't know	4	16.0	0	0.0	0	0.0	11.53 ns
Incomplete answer	20	80.0	19	76.0	20	80.0	
Complete answer	1	4.0	6	24.0	5	20.0	
Blood-Borne Virus							
Don't know	18	72.0	4	16.0	4	16.0	26.12**
Incomplete answer	7	28.0	13	52.0	16	64.0	
Complete answer	0	0.0	8	32.0	5	20.0	

Table 6 shows comparison between nurses' application of infection control precaution on pre test, post test and retention test at beginning, and during hemodialysis procedure.

Nurses showed better application of Infection control precautions on post test and retention test than on pre test. Therefore, there were highly statistical significant difference at level 1% of statistical significance except for needle insertion (P>0.05).

Table 7 shows comparison between nurses' application of Infection control precautions on pre test, post test and retention test at the end of session Nurses showed better infection control practices on post test and retention test than on pre test. Therefore there was a highly statistical significant difference at 1% level of statistical significance

Table 8 shows comparison between pre, post & follow up groups regarding nurses' practices in the maintenance of hemodialysis unit environment Nurses showed better application of Infection control precautions on post test and retention test than on pre test. Therefore, there were statistical significant difference at 5% and 1%levels of statistical significance except for cleaning surfaces at station after treatment (P>0.05).

Table 3. Comparison between knowledge of nurses about disinfection of used equipment, hemodialysis machine and care of vascular access site on pre-test, post-test and retention test.

Knowledge about disinfection of used equipments, hemodialysis machine and care of vascular acess in HD unit.		Pre test (n=25)		Post test (n=25)		Retention test (n=25)		Fisher exact tes X^2
		No	%	No	%	No	%	
Methods of disinfecting of used equipments	Don't know	11	44.0	0	0.0	0	0.0	34.26**
	Incomplete answer	13	52.0	10	40.0	12	48.0	
	complete answer	1	4.0	15	60.0	13	52.0	
Disinfection of thermometer	Don't know	14	56.0	3	12.0	5	20.0	22.85**
	Incomplete answer	11	44.0	8	32.0	10	40.0	
	complete answer	0	0.0	14	56.0	10	40.0	
Disinfection of Sphygmomanometer Cuff	Don't know	2	8.0	0	0.0	0	0.0	19.06**
	Incomplete answer	20	80.0	8	32.0	12	48.0	
	complete answer	3	12.0	17	68.0	13	52.0	
Disinfection of stethoscope	Don't know	2	8.0	0	0.0	0	8.0	12.93*
	Incomplete answer	21	84.0	12	48.0	13	52.0	
	complete answer	2	8.0	13	52.0	10	40.0	
Disinfection of External hemodialysis machine	Don't know	16	64.0	2	8.0	5	20.0	28.59**
	Incomplete answer	9	36.0	11	44.0	15	60.0	
	Complete answer	0	0.0	12	48.0	5	20.0	
Disinfection of Internal hemodialysis machine	Don't know	2	8.0	0	0.0	0	0.0	19.05**
	Incomplete answer	20	80.0	8	36.0	12	48.0	
	Complete answer	3	12.0	17	64.0	13	52.0	
Care for vascular access	Don't know	2	8.0	0	2.0	2	8.0	12.93*
	Incomplete answer	21	84.0	12	48.0	13	52.0	
	Complete answer	2	8.0	13	52.0	10	40.0	

NB: ns p>0.05; *P<0.05; **P<0.001

Table 4. Comparison between Knowledge of nurses about disinfection and care for hemodialysis environment on pre test, post test and retention test

Knowledge about disinfection and care for hemodialysis environment		Pre test (n=25)		Post test (n=25)		Retention test (n=25)		Fisher exact test X^2
		No	%	No	%	No	%	
Cleaning of contaminated surfaces	Don't know	8	32.0	0	0.0	5	20.0	22.66**
	Incomplete answer	16	64.0	9	36.0	10	40.0	
	complete answer	1	4.0	16	64.0	10	40.0	
Care of contaminated linens	Don't know	7	28.0	0	0.0	0	0.0	15.44**
	Incomplete answer	18	72.0	25	100.0	25	100.0	
Care for sharp objects	Don't know	3	12.0	0	0.0	0	0.0	6.25*
	Incomplete answer	22	88.0	25	100.0	25	100.0	
Care for waste disposal of HD unit	Don't know	1	4.0	0	0.0	0	0.0	14.07*
	Incomplete answer	24	96.0	15	60.0	20	80.0	
	complete answer	0	0.0	10	40.0	5	20.0	
Care for spilled blood	Don't know	5	20.0	0	0	0	0.0	20.01*
	Incomplete answer	20	80.0	15	60	18	72.0	
	complete answer	0	0.0	10	40	7	28.0	
Care for hemodialysis environment	Don't know	5	20.0	0	0.0	4	0.0	13.83*
	Incomplete answer	20	80.0	17	68.0	18	72.0	
	complete answer	0	0.0	8	32.0	3	12.0	
Ideal characteristics of HD unit	Don't know	9	36.0	3	12.0	5	20.0	19.78**
	Incomplete answer	16	64.0	9	36.0	15	60.0	
	complete answer	0	0.0	13	52.0	5	20.0	
Monitoring water quality	Don't know	16	64.0	2	8.0	5	20.0	28.59**
	Incomplete answer	9	36.0	11	44.0	15	60.0	
	Complete answer	0	0.0	12	48.0	5	20.0	

Table 5. Comparison between knowledge of nurses about nosocomial infection and standard precautions for infection control according to their level of education

Knowledge about nosocomial infection & its control / Level of education		For diploma nurses N = 9		For Bachelor nurses N = 16		Fisher exact test X^2
		No	%	No	%	
Pre-test	**Knowledge about nosocomial infection**					
	Don't Know	9	100.0	16	100.0	
	Standard precautions for infection control					
	Don't Know	9	100.0	16	100.0	
Post test	**Knowledge about nosocomial infection**					
	Don't know	4	44.4	8	50.0	0.07 ns
	Know	5	55.6	8	50.0	
	Standard precautions for infection control					
	Don't know	5	55.6	3	18.8	3.59 ns
	know	4	44.4	13	81.3	
Retention test	**Knowledge about nosocomial infection**					
	Don't know	7	77.8	10	62.5	0.62 ns
	know	2	22.2	6	37.5	
	Standard precautions for infection control					
	Don't know	4	44.4	6	37.5	0.12 ns
	know	5	55.6	10	62.5	

Table 6. Comparison between nurses' application of infection control precaution on pre test, post test and retention test at beginning, and during hemodialysis procedure

Nurses' application on infection control on starting and during dialysis		Pre test (n=25)		Post test (n=25)		Retention test (n=25)		Fisher exact test X^2
		No	%	No	%	No	%	
Inserting needles	Inadequate Done	16	64.0	12	48	14	56	1.29 ns
	Adequate Done	9	36.0	13	52	11	44	
Discarding soiled material in plastic bag	Not Done	1	4.0	0	0	0	0	17.32**
	Inadequate Done	20	80.0	8	32	18	72	
	Adequate Done	4	16	17	68	7	28	
Removing gloves	Not Done	13	52.0	0	0.0	10	40.0	28.0**
	Inadequate Done	9	36.0	5	20.0	7	28.0	
	Adequate Done	3	12.0	20	80.0	8	32.0	
Routine hand washing after procedure	Not Done	6	24.0	0	0.0	4	16.0	11.68**
	Inadequate Done	10	40.0	5	20.0	8	32.0	
	Adequate Done	9	36.0	20	80.0	13	52.0	
Total Starting dialysis group	Poor	10	40.0	0	0.0	8	32.0	12.28**
	Good	15	60.0	25	100.0	17	68.0	
Hand washing between procedures	Not Done	20	80.0	8	32.0	18	72.0	27.48**
	Inadequate Done	4	16.0	0	0.0	2	8.0	
	Adequate Done	1	4.0	17	68.0	5	20.0	
Discard needles in sharp container	Not Done	5	20.0	2	8.0	3	12.0	5.19 ns
	Inadequate Done	18	72.0	15	60.0	16	64.0	
	Adequate Done	2	8.0	8	32.0	6	24.0	
Total performance during dialysis	Poor	20	80.0	4	16.0	10	40.0	21.09**
	Good	5	20.0	21	84.0	15	60.0	

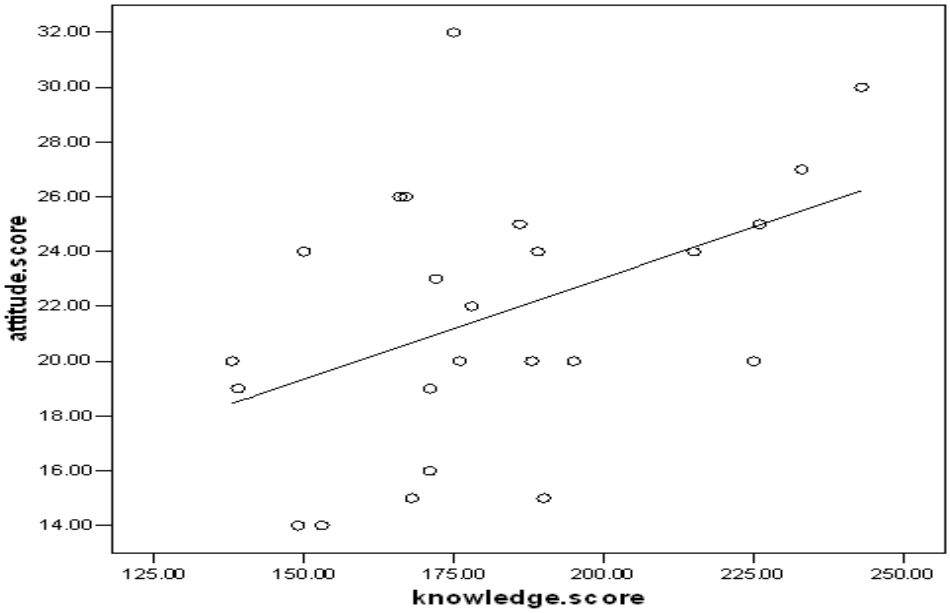
Table 7. Comparison between nurses' application of Infection control precautions on pre test, post test and retention test after the procedure

Infection control precautions after procedure		Pre test (n=25)		Post test (n=25)		Retention test (n=25)		Fisher exact test X^2
		No	%	No	%	No	%	
Disinfecting and rinsing the kidney machine	Inadequate done	20	80.0	4	16.0	21	84.0	30.33**
	Adequate done	5	20.0	21	84.0	4	16.0	
Handling linen	Not done	5	20.0	0	0.0	0	0.0	20.15**
	Inadequate done	19	76.0	13	52.0	15	60.0	
	Adequate done	1	4.0	12	48.0	10	40.0	
Care of non disposable equipments	Not done	25	100.0	25	100.0	25	100.0	-
Removing gown	Not done	25	100.0	25	100.0	25	100.0	-
Removing gloves	Not done	8	32.0	6	24.0	7	28.0	5.91 ns
	Inadequate done	15	60.0	10	40.0	13	52.0	
	Adequate done	2	8.0	9	36.0	5	20.0	
Removing mask & face shield	Not done	25	100.0	25	100.0	25	100.0	-
Total nurses' performance after procedure group	Poor	19	76.0	0	0.0	17	68.0	34.94**
	Good	6	24.0	25	100.0	8	32.0	

Table 8. Comparison between nurses' practice in the maintenance of hemodialysis unit environment on pre, post and retention test (treatment area)

Nurses' Practices In Maintaining Hemodialysis Unit Environment (Treatment Area)		Pre (N=25)		Post (N=25)		Follow Up (N=25)		Fisher Exact Test X^2
		No	%	No	%	No	%	
Cleaning Blood Spills	Not Done	6	24.0	0	0.0	0	0.0	15.58**
	Inadequate Done	5	20.0	2	8.0	4	16.0	
	Adequate Done	14	56.0	23	92.0	21	84.0	
Dialyzing The Patient With HBV, HCV Or HIV In Separate Room	Not Done	25	100.0	25	100.0	25	100.0	-
Using Common Carts In The Patient Treatment Area	Not Done	15	60.0	0	0.0	5	20.0	23.86**
	Adequate Done	10	40.0	25	100.0	20	80.0	
Using Air Condition	Not Done	16	64.0	8	32.0	15	60.0	6.09*
	Adequate Done	9	36.0	17	68.0	10	40.0	
Keeping Door Closed	Not Done	19	76.0	8	32.0	16	64.0	10.57**
	Adequate Done	6	24.0	17	68.0	9	36.0	
Closing Windows	Not Done	14	56.0	4	16.0	10	40.0	8.66*
	Adequate Done	11	44.0	21	84.0	15	60.0	
After Treatment, Cleaning Surfaces At Station	Not Done	24	96.0	18	72.0	20	80.0	5.21 Ns
	Adequate Done	1	4.0	7	28.0	5	20.0	
Total Treatment Area Score	Poor	14	56.0	0	0.0	4	16.0	22.81**
	Good	11	44.0	25	100.0	21	84.0	

Figure 3. Pearson correlation between total nurses' knowledge and attitude on post test.: it illustrated that there was a highly statistical significant positive correlation at 1% between knowledge and attitude on post test



DISCUSSION

Infection control is increasingly perceived as an important part of a wider risk management and patient safety agenda. Nurses should be aware of the practices that help in minimizing infection and be able to demonstrate these practices to patients to achieve high quality competences (Whyte and Fine, 2008)

This study revealed that about two thirds of nurses had Bachelor degree and there was no statistical significant difference between Bachelor and Diploma nurses. This result was consistent with Ebrahem (2009) who reported that highest percentage of nurses working in hemodialysis unit was having Bachelor degree in nursing in contradiction with Mohamed (2007) and Fathalla (2009) who reported that number of nurses were having secondary degree Diploma nursing were more than number of nurses who were having Bachelor degree. This inconsistency could be related to the preference of the administration of Minofiya University Hospital to assign nurses with Bachelor degree in this critical unit to provide those children with competent skills and knowledge. However, More than half of them (60%) did not attend any infection control training program. This result was inconsistent with Malan (2009) who reported that majority of nurses must attended an infection control training program. This difference could be related to the lack of training units that are responsible to design programs to upgrade nurses.

Children's age range were 8-19 years. In this respect, James et al., (2002) and Mohamed (2007) stated that the incidence of chronic renal failure was higher in adolescents. This occur due to repeated urinary tract infection, glomerulonephritis, arteriopathic renal diseases and wrong eating habits such as eating much salt, too much meat with high potassium diet and drinking beverage instead of water.

Also, more than half of children were girls. This result was inconsistent with James et al., (2002) and Ebrahem (2009) who cited that the incidence of chronic renal failure among boys' children is higher than girls.

The most common virus detected among those children was hepatitis C virus (HCV) this was consistent from the beginning till the end of the study. This results was correspondence with National Health Service. (2004). who reported that HCV is the most common blood born virus compared to HBV and HIV besides, Abou El-Enein, and El Mahdy, (2011) stated that Egypt has the highest prevalence of HCV infection in the world and till now there is no efficient treatment available for those viruses. In addition to, unavailability of places for child isolation setting at hospital which interpret that all patient untreated in special dialyzer

In relation to nurses' knowledge about blood borne viruses, the present study showed that there was a highly statistical significant difference between post test, retention test than pre test. This result was supported by El Badawy (1998) and Robert (2000) who enhanced the role of education in improving nurses' knowledge. However, their practice still incompetent due to lack of facilities

Nurses' knowledge about disinfecting hemodialysis machine, care of vascular access, care for hemodialysis environment and monitoring water quality, the nurses gain

better knowledge on posttest about healthy environment, cleaning of contaminated surfaces, Care of contaminated linens, Care for sharp objects, Care for waste disposal of hemodialysis unit, Care for spilled blood, Care for hemodialysis environment, Ideal characteristics of hemodialysis unit, monitoring water quality and standards for the quality of water used for dialysis. The present study showed that there was a highly statistical significant difference on post test and retention test than on pre test. This result was consistent with Higgins and Evans (2008) and Fathalla (2009) who reported that there was a statistical significant difference in nurses' knowledge about vascular access. This could show that nurses acquired better knowledge through educational programs about care of vascular access and hemodialysis environment. which is reflected on their child; care and competence level

Although, the nurses know well the importance of hand washing for infection control, More than two thirds of nurses inadequately or infrequently performed and there were no statistical significant differences between their performance on pre test, post test and retention test. This result could be attributed to nurses' preference to rub hands with alcohol due to work overload in that area. On pre test, the majority of nurses (80.0 %) performed hand washing inadequately. This finding was consistent with National Health Service. (2004). who reported that hand washing is a complicated task comprising not only choice of appropriate disinfecting agent, but also frequency, duration, appropriateness, and liability for skin irritation from frequent washing.

For wearing overshoes, wearing mask and goggles, and sterile gowns, all nurses (100.0 %) didn't use these protective measures due to their ignorance about the importance of these protective measures and the unavailability of these supplies. These findings were consistent with, Abd El-Nabiy (2011)[j] who reported that lack of infection control equipment and supplies was one of the major hindering factors to the application of precautions.

Concerning children's preparation (care for vascular access) for hemodialysis session, the present study illustrated that there was a highly statistical significant difference between, post test and retention test than pre test. These differences were related to more adequate performance on post test and retention test. On pre test, all nurses (100.0%) provided inadequate children's preparation. These findings were consistent with Dawood (2011). On the other hand, theses findings were inconsistent with Ebrahem (2009) and Fathalla (2009) In this regard, The National Kidney Foundation (2011) stated that the access site should be washed with soap and water then access limb should be placed on sterile drape prior to cannulation to decrease the microflora that can be introduced inadvertently into children's blood stream.

Discarding soiled material in a plastic bag, the present study revealed that this practice was adequately done on pre test only by 16.0% of nurses. This result was consistent with Ebrahem (2009) who reported that studied nurses segregated clinical from non clinical wastes. However, The World Health Organization (2004) instructed that clinical wastes should be separated from non clinical wastes in specific containers. On post test, (68.0%) of nurses had more adequate performance due to provided educational program. On retention test, had more inadequately done practice in this regard, it could be attributed to the fact that auxiliary personnel were used to discard soiled materials in specific containers. This suggests that auxiliary personnel should be integrated into continuous in-service training to be accustomed them in standard practices.

For total nurses' performance in infection control precautions on starting hemodialysis procedure, nurses had better performance on post test and retention test. This was attributed to their ingestion for program knowledge and they were accustomed to practice their guidelines.

Regarding nurses' application of infection control precautions during dialysis, and at terminating dialysis as well as after session. Only (8.0%) of nurses discarded needles in sharp container on pre test, all nurses applied sterile dressing on the shunt and wrapped it securely. This result was consistent with El Ghamdi (2004), Mohamed (2007[j] Ebrahem (2009) and Abd El-Nabiy (2011) who reported that nurses threw out needles in leak-proof, puncture-resistant and color –coded boxes throughout all hemodialysis procedures. This could be attributed to lack of supervision. On post test and retention test, nurses had more adequate performance due to insistence on their lack point during educational program .

On pre test, the majority of nurses (80.0 %) performed disinfection and rinsing for hemodialysis machine inadequately. This finding was consistent with Mohamed (2007) who reported that nurses rinsed fluid pathway after every dialysis with dialox or citrosteril for 30 minutes. Also, this result consistent with Ebrahem (2009) [(13)] who reported that half of nurses disinfected external surfaces of hemodialysis machine.

For the care of non disposable equipment, removing mask and goggles, and sterile gowns, all nurses (100.0 %) didn't perform these procedures due to the unavailability of these supplies. These findings were consistent with Ebrahem (2009) and Abd El-Nabiy (2011) who reported that lack of infection control equipment and supplies were the major obstacles to apply infection control properly.

Nurses' practices in treatment area, the majority of nurses adequately cleaned blood spills on post test and retention test and there was a highly statistical significant difference between nurses' performance on, post test and retention test than pre test. This result was consistent with Mohamed (2007) who reported that many authors cited that safe environment was very important for the patient's good. Therefore, it was important for nurses to clean hemodialysis area from spilled blood and body fluids with chloride to

maintain safe environment and prevent the transmission of infection.

Regarding dialyzing children with blood borne viruses (HBV, HCV, HIV) in a separate room, all nurses didn't dialyze children with blood borne viruses. This could be attributed to unavailability of extra rooms for isolation and the shortage of nursing staff. Also, the hospital policy insists on referring children with HBV and HIV to fever hospital.

Regarding total nurses' practices in treatment area, utilization and attitude toward healthy behavior, the nurses demonstrated better performance on post test (100.0%) and retention test (84.0%) and there was a highly statistical significant difference between nurses' performance on post test and retention test than pre test. This could be attributed to the effect of educational program which changes attitude to the best practice..

Furthermore, nurses showed less adequate infection control knowledge and practices on retention test than on pre test. This could be due to the elapse of three months period following the educational program and the fact that nurses are exposed to forget. On the other hand, this reflected that nurses needed continuous educational program to develop their knowledge and skills.

CONCLUSION

Based on the finding of the present study, the following is concluded: that Infection Control Competency based protocol improved competencies of hemodialysis nurses regarding infection control and the occurrence of blood born infection.

RECOMMENDATIONS

A- Recommendations for nursing practice:-

1. A health education unit should be established inside every hospital to upgrades nurses knowledge and practices.
2. Written booklets, posters and videos should be available in each unit in hospital to acknowledge nurses about infection control procedures.
3. Physicians and auxiliary personnel should be included in infection control health education programs.
4. Adequate and appropriate supplies must be available and accessible for nurses at all time to facilitate infection control practice.

b- Recommendations for nursing research:

1. This study can be applied in other critical settings on large sample to ensure generalizability of the study.

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