Nurses' Adherence to Egyptian Standard Infection Control Guidelines in Pediatric Hemodialysis Unit

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Abstract

Background: *A health care-associated infection (HCAI) is defined as "an infection that initially manifests 48 hours or more after hospitalization, or within 30 days after receiving medical treatment." It may result in increased rates of morbidity and mortality as well as longer hospital stays. In order to lower the occurrence of HCA, pediatric nurses in hemodialysis (HD) units must strictly adhere to established infection control procedures.* ***Aim:*** *The study aimed to assess nurses' adherence to Egyptian standard infection control guidelines in pediatric HD unit.* ***Setting:*** *The study was conducted in Kidney Dialysis Unit at Smouha University Children's Hospital.* ***Subjects:*** *All nurses who were responsible for providing direct care for children undergoing HD (30 nurses).* ***Tool:*** *One tool was used to collect necessary data: Nurses' adherence to Egyptian standard infection control guidelines observational checklist.* ***Results:*** *The majority of the nurses had high satisfactory scores concerning adherence to hand hygiene, wearing personal protective equipment, safe injection, waste disposal, cleaning and disinfection of environmental surfaces and handling of disposable supplies/ instruments/ equipment (93.3%,95.8%,95.0%,98,3%,92.5% and 91.7% respectively).* ***Conclusion:*** *It was concluded that the highest percentage of the studied nurses had overall "high Satisfactory" adherence to Egyptian Standard Infection Control Guidelines.* ***Recommendations:*** *Based on the previous findings and conclusion: The recent Egyptian standard infection control guidelines should be applied by the pediatric nurses in HD unit to guard against the occurrence of HAI.*

Keywords:

Nurses' Adherence, Egyptian Standard Infection Control Guidelines, Pediatric Hemodialysis Unit.

Introduction

Chronic renal failure is a condition in which the kidneys are damaged and can't filter the blood the way they should. The damage can cause wastes and fluid to build up in the body that end with End Stage Kidney Disease (ESKD) (Warady &Weidman, 2021). The global prevalence of ESKD is between 18 to 100 per million age-related populations, of whom approximately 25% are on dialysis (Raina et al., 2024).

Dialysis keeps a child's body in balance by removing extra fluid and removing wastes. It has two types peritoneal dialysis and Hemodialysis (HD) (Dawson et al., 2023)

The child undergoing HD must have vascular access through which the blood can be removed and returned. The primary method of performing long-term HD in children is with tunnelled cuffed central venous catheters. (United States Renal Data System, 2018).

Children undergoing HD are vulnerable to contacting HealthCare-Associated Infections (HCAIs) as catheter-related blood stream infections due to frequent and prolonged exposure to many possible contaminants. Children weakened immune systems, the extracorporeal nature of the treatment, and related prevalent environmental conditions In 2021, Onder and Somers; in 2018, the United States Renal Data System.

In pediatric HD units, following basic infection control procedures is crucial. Guidelines were established by the Egyptian Society of Nephrology and Transplantation in 2019. The general principles including nursing guidelines before, during, and after HD (Hafez et al., 2020).

Nursing guidelines before HD include preparation of the children as vascular access care, preparation of equipment as HD machine and Personal Protective Equipment (PPE), and the initiation of the HD procedure. Nursing guidelines during HD as monitoring the vascular access and line connection, measuring temperature hourly, hand hygiene and wearing sterile gloves before any contact with children. While, nursing guidelines before the termination of HD procedure involve performing hand hygiene, wearing sterile gloves, meticulous vascular access care, sterilization of HD machine and equipment (Levy et al., 2019).

Hemodialysis nurses occupy a significant place in the wide spectrum of care as they have prolonged contact with children from the start to the end of HD procedure. Since they play a crucial part in severing the chain of infection by adhering to accepted infection control practices, they are the cornerstone of successfully managing children undergoing HD. In order to ensure safe dialysis and zero infections in HD units, the Centres for Disease Control and Prevention (CDC) created a staff training program in 2016 (Centres for Disease Control and Prevention, 2016). Regretfully, nurses occasionally use optional methods for infection prevention measures (Hinkle & Cheever, 2014). Additionally, a number of issues, such as a lack of nurses, a high child population, staff turnover, inadequate training, a lack of supplies, and the urgency of the children, may make it difficult for nurses to follow these precautions. So, the study aimed to assess nurses' adherence to Egyptian standard infection control guidelines in pediatric HD.

Aims of the Study

The aim of the current study was to assess nurses' adherence to Egyptian

standard infection control guidelines in pediatric HD unit.

Research question

Do nurses adhere to Egyptian standard recommendations for infection control in the paediatric HD unit?

Materials and Method

Materials

Design:

A descriptive research design was used.

Setting:

This study was conducted at the Kidney Dialysis Unit in Smouha University Children's Hospital.

Subjects

The study subjects included all 30 nurses who were in charge of caring for children undergoing HD in the aforementioned environment.

Tool

One tool was used to collect the data: - Nurses' Adherence to Egyptian Standard Infection Control Guidelines in Pediatric HD Unit Observational Checklist: -

The tool was adapted from Egyptian standard infection control guidelines by the CDC (2016) and World Health Organization (WHO) (2022) and relevant literature (Hafez et al., 2020). It was used to assess the nurses' adherence to Egyptian standard infection control guidelines in the pediatric HD unit.

The observational checklist included six basic elements of standard precautions; which included the following procedures:

- Hand hygiene included type, frequency and technique.
- Wearing PPE.
- Cleaning and disinfection of environmental surfaces.
- Handling of disposable supplies, instruments and equipment.
- Safe injection: preparation of medication and syringe disposal.
- Waste Disposal.

The tool included information about the nurses' age, education, years of experience, and participation in HD training programs. Each step of each procedure was scored as follows; completely done was given score (1) and not done or incorrectly done was given score (zero). The total number of each procedure was transformed into percentage. The average percentage of all procedures was calculated and finally nurses' adherence classified as follows:

-High satisfactory adherence level = ≥80%
- Satisfactory adherence level = 60% - <80%
-Unsatisfactory adherence level = <60%

Method

- Approval from Research Ethics Committee, Faculty of Nursing, Alexandria University was obtained before carrying out the study.
- To obtain their consent to carry out the study, a formal letter was sent to the Kidney Dialysis Unit's competent authority.
- The tool was adapted from Egyptian standard infection control guidelines by the CDC (2016), WHO (2022) and relevant literature (Hafez et al., 2020) to assess nurses' adherence to Egyptian standard infection control guidelines in pediatric HD unit.
- Five pediatric nursing specialists evaluated the tool's content validity. The tool's validity rate was 95.33%.
- The Cronbach Coefficient Alpha Test was used to confirm the tool's reliability, with r=0.854.
- 10% of nurses participated in a pilot trial to determine the tool's viability and applicability; these nurses were removed from the study when the required adjustments were made.

- Every nurse was observed twice during morning shifts and twice during afternoon shifts while providing care for the children undergoing HD from admission till discharge from the HD unit to assess nurses' adherence to Egyptian standard infection control guidelines before, during, and after the HD procedure using Tool one.
- Each observation took an average of six hours. Nurses were not aware that the researcher observed their performance.
- In the nurses' office during the break, each nurse was questioned separately about her age, education, years of experience, and attendance at HD training programs.
- Data were collected over a period of six months from October 2022 to March 2023.
- After completion of data collection, the necessary statistical analysis was used to assess the nurses' adherence to Egyptian standard infection control guidelines in a pediatric HD unit.

Ethical Considerations

1-Written witness informed consent was obtained from the head nurse after an explanation of the aim of the study.

2-Confidentiality of the collected data was assured.

Statistical Analysis

Version 23.0 of the SPSS software package was used to analyse the data that was supplied into the computer. Numbers and percentages were used to identify qualitative data. The mean and standard deviation were also used to identify quantitative data. The 5% level was used to assess the results' significance.

The used tests were

1- The chi-square test is used to compare groups for categorical variables.

2 - Monte Carlo correction: For chi-square when more than 20% of the cells have the expected count.

Results

Table (I) depicts traits of the nurses under study. With a mean age of 34.27 ± 8.40 years, the table shows that nearly one-third of the nurses were between the ages of 20 and less than 30 and between the ages of 30 and less than 40 (33.3% and 36.7%, respectively). Seventy percent of the nurses have a bachelor's degree in nursing. In contrast, just 10.0% of the nurses had a technical institute of nursing diploma, while 20.0% of them had a secondary nursing school qualification.

According to the same chart, 40.0% of the nurses had either less than five years of experience or fifteen years or more of experience in the HD unit. With a mean of 11.37 ± 10.06 years, 6.7% had 5 to less than 10 years of experience, and 13.3% had 10 to less than 15 years.

The same table also revealed that 76.7% of the nurses have participated in training sessions for infection prevention in the HD unit. Sixty-nine percent of the nurses had not attended a training workshop in less than a year.

Figure (I) describes the percent scores of nurses' adherence to Egyptian standard infection control guidelines in pediatric HD Unit. The majority of the nurses (90.0%) obtained high satisfactory adherence. While, only 10% of them had unsatisfactory adherence.

Table (II) Illustrates the distribution of the studied nurses in relation to percent score for their adherence to Egyptian standard infection control guidelines in HD unit. It was found that the highest percentages of nurses' high satisfactory adherence were noticed among safe injection, waste disposal and handling of disposable supplies/ instruments/ equipment (96.7%). The mean

percent scores of adherence to safe injection, waste disposal and handling of disposable supplies/ instruments/ equipment were 98.3±9.1, 98.2±10.0 and 97.5±13.7 respectively.

Table (III) shows the relation between total percent score of nurses' adherence to Egyptian standard infection control guidelines in pediatric HD unit and their characteristics. It was noted that there was no statistical significant relation between the total percent score of nurses' adherence to Egyptian standard infection control guidelines in pediatric HD unit and either their age or years of experience. Conversely, the current study findings reflected that a statistical significant relations were detected between the total percent score of nurses' adherence to Egyptian standard infection control guidelines in pediatric HD unit and their level of education (P = 0.010) as well as their attendance of training program about infection control in pediatric HD unit (P = 0.005).

Discussion

Health care-associated infections in pediatric HD units represent a significant concern due to the vulnerable population of children undergoing regular HD. Serious side effects, including as prolonged hospital admissions, elevated morbidity, and mortality, can arise from these infections.

An increased risk of HCAIs is related to the use of invasive devices as central venous catheters, contamination of HD equipment, and frequent HD sessions. Accordingly, current knowledge and improved practical nursing skills might be crucial in reducing healthcare-associated infections (HCAIs) (Warren et al., 2023).

Pediatric nurses in HD units are instrumental in reducing HCAIs by adhering to the Egyptian standard infection control guidelines Broussard (2023). In such perspective, the current findings reflected that nearly three quarters of the nurses had Bachelor of nursing, while the lowest percentage of them had diploma of technical institute of nursing **(Table I)**. This result could be justified by the concern of the university hospitals to employee bachelor nurses to work particularly in the HD units to guarantee the achievement of high quality care. The findings of the current study concur with those of Ahamed & Sallam (2018), who found that over 50% of the nurses in the HD unit have a bachelor's degree in nursing. However, this finding contradicts the findings of Ibrahim et al. (2019), who examined nurses' performance in caring for children undergoing HD and discovered that almost three-quarters of them held nursing diplomas, whereas the minority held nursing bachelor's degrees.

The current study demonstrated that, with regard to years of experience, two-fifths of the nurses had either less than five years of experience or at least fifteen years. **(Table I)**. This finding may be due to most of the studied nurses were recently graduated or due to deputation of expert nurses from other departments to overcome the shortage in the number of the staff. This finding is corresponding with the finding of Eslam et al. (2020) who showed that more than one third of the studied nurses in HD unit had five to less than ten years of experience.

Concerning the attendance of training programs about HD, the present study finding clarified that more than three-quarters of the nurses attended training workshops about infection control in HD unit **(Table I)**. This finding may be related to abundant of finances to support ongoing education to enhance the quality of care for those who are working in especial unit as HD. This is supported by Mohamed & Sadek (2023) who studied nursing intervention for application of safety measures for children undergoing HD. On

the contrary, Morkes et al. (2018) and Machaly et al.(2020) discovered that the main reasons for noncompliance with infection control measures are a lack of information, a heavy workload, and inadequate training.

Regarding the nurses' general adherence, the current study's findings showed that the majority of the nurses under investigation achieved high levels of satisfactory adherence to the Egyptian standard infection control standards in paediatric HD units **(Figure I)**. Numerous factors can illuminate this result. The close supervision from infection control team about the accurate techniques of hand hygiene and the application of the PPE via consistent training sessions and reminders, which improved nurses' adherence to the Egyptian standard infection control guidelines. As well, availability of necessary resources (e.g., PPE, disinfectants, proper ventilation) may have facilitated adherence. Moreover, more than three-quarters of the nurses attended training workshops about infection control in HD unit which may had a constructive impact on their adherence **(Table I)**.

The present finding is align closely with that of Refeai, et al. (2020) in Egypt, they found that the majority of the healthcare workers demonstrated positive perceptions toward infection prevention and control and standard precautions. In contrast, this result is contradicted with the finding of Yousef et al. (2019) who executed a study in the renal dialysis unit at Assiut Children's University Hospital, Egypt, and stated that the knowledge and practices of the nursing staff were inadequate before the implementation of the educational program. In addition, Osman et al. (2021) and Bagheban et al. (2018) found that nurses in HD units had poor practices regarding infection control measures.

Proper handling and disposal of PPE, sharps and wastes after doffing is vital and needs proper training for performing correctly. It was revealed that waste disposal, safe injection and handling of disposable supplies/ instruments and equipment item constituted the primary rank of nurses' adherence to Egyptian standard infection control guidelines **(Table II)**. This may be due to many reasons as nurses' awareness about the importance of adherence to the Egyptian standard infection control guidelines in reducing HCAIs as almost three quarters of them were Bachelor of Nursing graduates **(Table I),** close monitoring of the nurses' adherence to infection control precautions\ئ by infection control committee and strict punishment for those who don't comply, availability of isolation rooms in HD unit with continuous surveillance of segregation practices by hospital infection control committee and encouraging prompt reporting and implement of infection control guidelines, the availability of equipment and supplies as color bags for waste management, the safety box for sharps disposal. These findings were partially in concord with the findings of Mohamed & Alanwer (2021) who concluded that more than one-half of the nurses' compliances with waste disposal in addition to that safe handling and disposal of sharps had the higher percentage of nurses' who had high compliance. These align with Chakraborty and Roy, (2021) who settled that proper handling of biomedical wastes and segregation of wastes as per classification can help in preventing disease in the community and among health care providers. On the other hand, the current study findings were contradicted with Tabash and Ashraf (2018) and Njue et al. (2015) who mentioned that nurses' compliance of waste disposal level was low.

The present study finding exemplified that there was no statistical significant relation between the total score of nurses' adherence to Egyptian standard infection control guidelines and their years of experience. **(Table III)**. Contrariwise, Machaly et al (2020) found that there was a significant statistical relationship between nurses' overall practice and their years of experiences. The present study illustrated that there was a statistical significant relation between the total score of nurses' adherence and their attendance of training program. This result could be due to the presence of infection control nurse in the HD unit who implemented training program in regular bases for nurses. The current study finding also reflected a statistical significant relation between nurses' adherence and their level of education. This might be because nurses with high education levels may possess a deeper understanding of the technical aspect of infection control measures which leading to enhance their adherence to infection control guidelines. The current results were consistent with the results of Bayoumi and Mahmoud (2017) who reported that the educational level and the attendance of training courses had significantly improved nurses' practice levels.

Conclusion

According to the findings of the current study, it can be concluded that the majority of the nurses obtained high satisfactory adherence to Egyptian standard infection control guidelines in pediatric HD unit. While, the minority of them had unsatisfactory adherence.

Recommendations

Based on the previous findings, the following recommendations are suggested:

- The recent Egyptian standard infection control guidelines should be applied by pediatric nurses in HD unit to guard against the occurrence of HCAIs.
- Continuous in-services education and training programs on recent Egyptian standard infection control guidelines should be offered to the pediatric nurses in HD unit regularly.
- Replicate the study on a larger sample in different institutional hospitals.

Limitations

The study was executed in a particular institutional hospital with 30 nurses, which may limit the generalization of its results.

Author contributions

***Marwa Ibrahim Said Ali,* Teacher:** Played a significant role in data collection, analysis, and interpretation**,** research methodology, writing a literature review, study discussion, conclusion, and recommendation and organizing references.

Nadia Medany Helaly,* Professor*: Supervised all thesis stages such as writing thesis protocol, and development of tools. Helped in research methodology, interpretation of results, study discussion, conclusion, and recommendation and organizing references.

***Abeer Abd El Razik Ahmed,* Professor:** Supervised all thesis stages such as writing thesis protocol, and development of tools. Be of assistance in research methodology, interpretation of results, study discussion, conclusion, and recommendation and organizing references.

***Hanan Mabrouk Ramadan,* Lecturer:** revised protocol and helped in development data collection tool and results interpretation. Be of assistance in research methodology, interpretation of results, study discussion, conclusion, and recommendation and organizing references.

Table (I): Characteristics of the Studies Nurses

Nurses' Characteristics	Total (n = 30)	
	No.	No.
Age		
20-	10	33.3
30-	11	36.7
40-	7	23.3
≥50	2	6.7
Mean ±SD	**34.27±8.40**	
Level of education		
Diploma of Secondary nursing school	6	20.0
Diploma of Technical institute of nursing	3	10.0
Bachelor of nursing	21	70.0
Years of experience		
<5	12	40.0
5-	2	6.7
10-	4	13.3
≥15	12	40.0
Mean ±SD	**11.37±10.06**	
Attendance of training program about infection control in pediatric Hemodialysis unit		
Yes	23	76.7
No	7	23.3

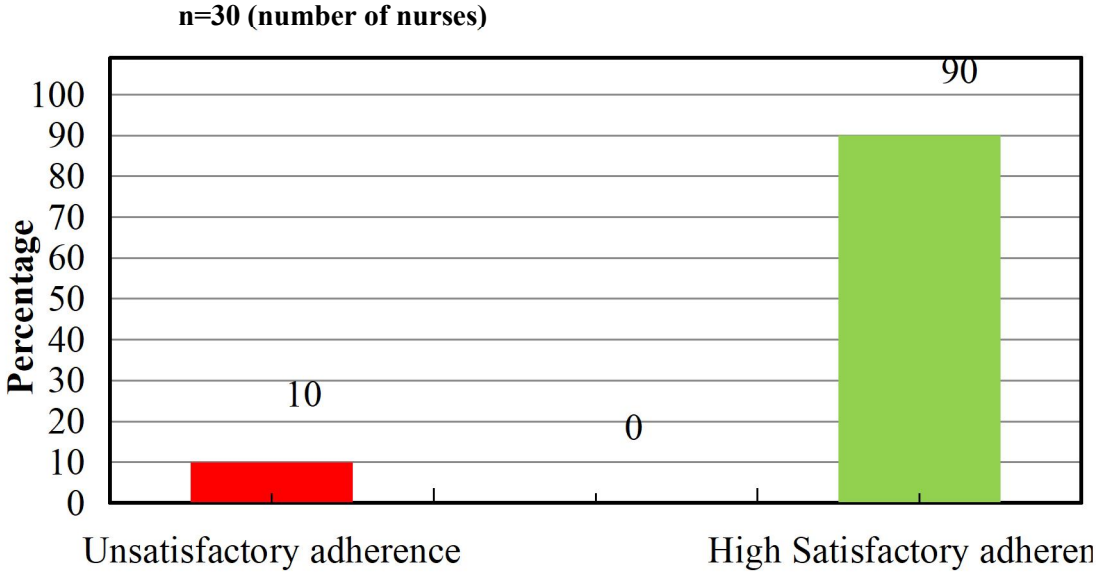

Figure (I): Total Percent Score of Nurses' Adherence to Egyptian Standard Infection Control Guidelines in Pediatric HD Unit

Table (II): Distribution of the Studied Nurses in Relation to Percent Score for their Adherence to Egyptian Standard Infection Control Guidelines in Hemodialysis Unit (number of average observations =30)

	Unsatisfactory Adherence <60%		Satisfactory Adherence 60% - <80%		High Satisfactory Adherence ≥80%		Mean percent score
	No.	%	No.	%	No.	%	Mean ± SD
I. Total score of Hand hygiene	3	10.0	2	1.7	25	83.3	93.2±15.7
Indication of hand hygiene	0	0.0	6	20.0	24	80.0	82.8±14.7
Technique of routine hand hygiene	1	3.3	4	13.3	25	83.3	93.0±16.0
Technique of antiseptic hand hygiene	0	0.0	3	10.0	27	90.0	96.0±12.2
II. Total score of Personal Protective Equipment	1	3.3	1	3.3	28	93.3	95.8±10.0
Masking	1	3.3	2	1.7	27	90.0	94.4 ± 12.8
Gowning	0	0.0	0	0.0	30	100.0	99.3 ± 2.5
Gloving	0	0.0	0	0.0	30	100.0	99.3±2.3
III. Safe injection	1	3.3	0	0.0	29	96.7	98.3±9.1
IV. Waste Disposal:	1	3.3	0	0.0	29	96.7	98.2±10.0
V- Cleaning and disinfection of environmental surfaces	1	3.3	2	1.7	27	90.0	94.9±14.9
VI-Handling of disposable supplies/ instruments/ equipment:	1	3.3	0	0.0	29	96.7	97.5±13.7
Total	3	10.0	0	0.0	27	90.0	96.3±8.4

SD: Standard deviation

Table (III): Relation Between the Total Score of Nurses' Adherence to Egyptian Standard Infection Control Guidelines in Pediatric HD Unit and their Characteristics

Characteristics of the Studied Nurses	Total Score Of Nurses' Adherence				χ^2	^{MC}p
	Unsatisfactory Adherence (n = 3)		High Satisfactory Adherence (n = 27)			
	No	%	No	%		
Age (Year)						
20-	2	66.7	8	29.6		
30-	1	33.3	10	37.0	1.981	0.678
40-	0	0.0	7	25.9		
50-60	0	0.0	2	7.4		
Level of education						
Secondary nursing school	3	100.	3	11.1		
Technical institute of nursing	0	0.0	3	11.1	9.233*	0.010*
Bachelor of nursing	0	0.0	21	77.8		

Years of experience						
<5	3	100.	9	33.3		
5-	0	0.0	2	7.4		
10-	0	0.0	4	14.8	3.873	0.272
15-20	0	0.0	12	44.4		
Attendance of training program						
Yes	0	0.0	24	88.9	13.333*	0.005*
No	3	100.	3	11.1		
Time of training program about infection control in pediatric Hemodialysis (n=24)						
<1 year	-	-	15	62.5		
1-	-	-	3	12.5		
3-	-	-	4	16.7	-	-
4-5	-	-	2	8.3		

χ^2: Chi square test MC: Monte Carlo *: Statistically significant at $p \leq 0.05$

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