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Effect of Implementing Evidence Based Nursing Guidelines on Clinical Outcomes of Children Undergoing Hemodialysis

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Abstract: **Chronic kidney disease is a worldwide public health problem; approximately 18/1million of children suffers from chronic renal failure all over the world. Dialysis nurse plays a vital role in providing information, care, support, understanding and therapeutic counseling to the pediatric patient and his/her family throughout the entire illness. The study aimed to determine the effect of implementing evidence-based nursing guidelines on clinical outcomes of children undergoing hemodialysis. Subjects and method: Aquasi-experimental research design was utilized in this study. The study was carried out at the dialysis units of the Suez Canal University Hospitals and Ismailia General Hospital. A convenience sample of 60 nurses and 35 children undergoing hemodialysis was included in the study. Three tools were used; structured interviewing questionnaire sheet, observational checklists and children clinical outcomes assessment sheet. Results: Clinical outcomes of children were improved after implementing the nursing guidelines. There was a significant improvement in their intrahemodialytic blood pressure before and after three weeks of implementing the guidelines, where X2= 0.320 and p value=0.043. There was a highly statistically significant reduction in the frequency of intrahemodialytic muscle cramping and hypoglycemia three weeks after implementing the guidelines, where X2= 0.652, 3.320 and p value=0.000, 0.043 respectively. Conclusion: Nurses' knowledge and practices were improved which in turn improved the clinical outcomes of children as reduction in the frequency of intrahemodialytic hypotension, muscle cramps and hypoglycemia. Recommendation: Periodic explanation and demonstration of evidence-based nursing guidelines for all nurses to improve clinical outcomes of children during hemodialysis sessions.**

Keywords: **Children, clinical outcomes, evidence-based nursing guidelines, hemodialysis.**

I. INTRODUCTION

Chronic kidney disease is a worldwide public health problem; approximately 18/1million of children suffers from chronic renal failure all over the world **(Safouh et al., 2015).** The incidence of chronic renal failure (CRF) in the pediatric age group differs by region of the world. In the Middle East, the total number of patients with CRF is almost 100,000 patients, with a mean prevalence of 430 per million populations (PMP). In Egypt, the estimated annual incidence of chronic renal failure is around 74/million and the total prevalence of children on dialysis is 264 per million **(Dahnan et al., 2019).**

Causes of CRF in children include congenital structural defects such as obstructive uropathy. It may also be caused by an inherited condition such as familial nephritis or may result from an acquired problem such as glomerulonephritis; it may follow an infectious process such as pyelonephritis **(Sanna-Cherchi et al., 2018).**

Complications of CRF are many. Uremia, hypocalcemia, hyperkalemia, and metabolic acidosis occur. Uremic toxins deplete erythrocytes and the failing kidneys cannot produce erythropoietin, so severe anemia results. Hypertension is common and heart failure may occur. Hypocalcemia results in renal rickets (brittle bones). Growth is retarded and sexual maturation may be delayed or absent. Many children with CRF experience depression, anxiety, impaired social interaction, and poor self-esteem **(Berezin et al., 2019).**

Hemodialysis removes toxins and excess fluid from the blood by pumping the child's blood through a hemodialysis machine and then reinfusing the blood into the child. Needles to remove and reinfuse the blood are inserted into an arteriovenous fistula or a graft, usually located in the child's arm. Hemodialysis is an intermittent maneuver which is done 2-4 times per week, each session is 3-4 hours, depending on several factors to deliver an efficient dialysis **(Childers et al., 2015).**

Nurses can help by involving the pediatric patient as much as possible in their health care decision, informing them of all treatment options and placing an emphasis on self-care. Sometimes nurses fail to adopt modern or recent nursing care for the children undergoing hemodialysis due to the lack of knowledge **(Barsoum, 2018).** Therefore, the aim of the study was to determine the effect of implementing evidence-based nursing guidelines on clinical outcomes of children undergoing hemodialysis.

II. SUBJECTS AND METHOD

Research Design:

Aquasi-experimental research design was utilized in this study.

Study Setting:

The study was carried out at the dialysis units of the Suez Canal University Hospitals and Ismailia General Hospital which affiliated to the Ministry of Health and Population.

Subjects:

A convenience sampling of sixty nurses who provide direct care to children at hemodialysis units at the previously mentioned settings (thirty-six nurses working at Suez Canal University Hospitals and twenty-four nurses working at Ismailia General Hospital) was included in the study. The study also included thirty-five children undergoing hemodialysis under the following criteria: age ranged from six to eighteen years, both sexes and receiving three times hemodialysis per week for three or four hours.

Tools of data collection:

Three tools were used to collect the study data:

Tool (I): A structured interview schedule: which was developed by the researchers and written in Arabic language. It consisted of the following parts:

Part (1): Socio-demographic characteristics of the studied nurses as age, sex, level of education, place of work and years of experience.

Part (2): Socio-demographic characteristics of the studied children as age, sex, birth order, number of family members and residence.

Part (3): Medical history of the studied children as past and present medical history, diagnosis, duration by years on hemodialysis and duration of hemodialytic session.

Part (4): Nurses' knowledge about chronic renal failure and hemodialysis as anatomy and physiology of the urinary system, chronic renal failure, nursing care during hemodialysis, nursing care toward common intrahemodialytic complications and infection control precautions.

Scoring system for nurses' knowledge was as following:

- Correct answer was scored (1)

- Incorrect answer or do not know was scored (0)

The total score of nurses' knowledge was calculated and classified into to levels as following:

- Less than 60% was considered poor knowledge.
- 60% or more was considered good knowledge.

Tool (II): Observational checklists: which were adopted from **(Bowden, Greenberg 2012)** to assess nurses' practices regarding care of children undergoing hemodialysis, including predialysis nursing activities, intradialysis nursing activities, post dialysis nursing activities and nursing interventions with the common intrahemodialytic complications occurring to children during hemodialysis sessions.

Scoring system for nurses' practices was as following:

- Done correctly and complete was scored (1)
- Done incorrect or not done was scored (0)

The total score of nurses' practices was calculated and classified into to levels as following:

- Less than 60% was considered unsatisfactory.
- 60% or more was considered satisfactory.

Tool (III): Children clinical outcomes assessment sheet: which was adopted from **(Wilson, Rodgers 2016)** to assess clinical outcomes of children undergoing hemodialysis, including assessment of weight, height, vital signs (temperature, pulse, respiration and blood pressure) that were measured during hemodialysis sessions, condition of skin around access site, urinary elimination, bowel elimination, intrahemodialytic muscle cramps, glucose level.

Field work

- The actual field work started from March, 2019 to the end of October, 2019.
- The researcher was available 3 days weekly (Saturdays, Wednesdays, Thursdays at Suez Canal University Hospital during morning shifts) and Ismailia General Hospital during the afternoon shifts.
- Assessment of nurse's knowledge and practices (pretest) carried out from the beginning of March, 2019 to the end of May, 2019. During this period all nurses were individually interviewed to fulfill the questionnaire sheet in their areas and were observed during their actual practices regarding the care of children undergoing hemodialysis (pre, during and post dialysis) and the researcher also assessed clinical outcomes of the children.
- After that the evidence-based nursing guidelines were implemented by the researcher from the beginning of June, 2019 to the mid July, 2019.
- The evidence-based nursing guidelines consisted of 9 sessions for each group of nurses and the duration of each session ranged from 30-45 minutes.
- ***The first session*** focused on anatomy of the renal system, functions of the kidneys, definition of chronic renal failure, types of renal failure, causes and common manifestations of CRF. ***The second session*** focused on periodical investigations for children with CRF, complications and management of CRF. ***The third session*** focused on definition of hemodialysis, mechanism of action of the dialyzer and types of connections. ***The fourth session*** focused on guidelines of care for children undergoing hemodialysis regarding predialysis nursing activities as checking vital signs, measuring child weight, observing signs of local infection, abdominal discomfort/ distention, nausea, vomiting, diarrhea, irritability and checking machine patency and all alarms before hemodialysis. ***The fifth session*** focused on guidelines of care for children undergoing hemodialysis regarding intradialysis nursing activities as checking blood pressure, pulse, venous pressure, arterial pressure, volume of fluid removed, and ultra-filtration rate and heparin dose delivered, changing position of child and mouth care in case of nausea or vomiting**.** ***The sixth session*** focused on guidelines of care for children undergoing hemodialysis regarding postdialysis nursing activities as measuring vital signs, measuring weight, providing routine care for access, check circulation, record lab (BUN, serum creatinine, serum electrolytes and hematocrit). ***The seventh session*** focused on common intrahemodialytic complications, it's causes and nursing management. ***The eighth session*** focused on

healthy dietary guidelines for children with CRF. ***The ninth session*** focused on infection control precautions during hemodialysis.

- Post-test was conducted from the beginning of August, 2019 to the end of October, 2019 using study tools I, II and III to assess changes in nurses' knowledge and practices and also to assess changes in clinical outcomes of the children.

Statistical analysis

The collected data were organized, tabulated and statistically analyzed using SPSS software (Statistical Package for the Social Sciences, version 21, SPSS Inc. Chicago, IL, USA). For quantitative data, the range, mean and standard deviation were calculated. For qualitative data, which describe a categorical set of data by frequency, percentage or proportion of each category, comparison between two groups and more was done using Chi-square test ($\chi 2$). Significance was adopted at $p<0.05$ for interpretation of results of tests of significance.

III. RESULTS

Table 1: Percentage distribution of the studied children regarding their socio-demographic characteristics

socio-demographic characteristics	The studied children (n=35)	
	No	%
Age (years)		
12- <15	8	22.9
15- 18	27	77.1
Mean±SD	**16.22±1.95**	
Birth order		
First	16	45.7
Second	13	37.1
Third	6	17.1
Child diagnosis		
Chronic renal failure	35	100
Acute renal failure	0	0.00
Number of family members		
3 persons	8	22.9
4- 6 persons	18	51.4
> 6 persons	9	25.7
Place of residence		
Rural	23	65.7
Urban	12	34.3

Table (1) shows that more than three quarters (77.1%) of the studied children were aged between 15 to 18 years with the mean age score 16.22±1.95. Also, 45.7% were ranked as first child. All children were diagnosed as chronic renal failure, 51.4% of them had a family consisting of 4-6 persons and 65.7% of them were living in rural areas.

Figure 1: Percentage distribution of the studied children regarding their gender (n=35)

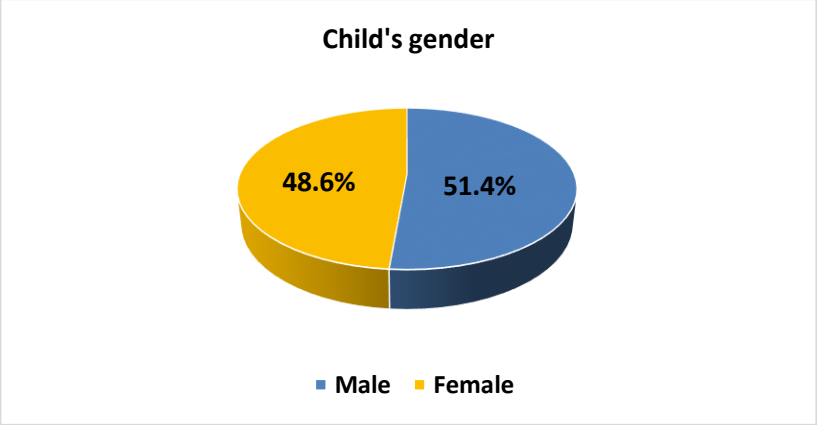

Figure (1) shows that slightly more than half (51.4%) of them were males and 48.6% of them were females.

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Table 2: Percentage distribution of the studied children regarding their medical history

Medical history	The studied children (n=35)	
	No	%
Suffering from previous health problems		
Yes	9	25.7
No	26	74.3
Type of health problem (n=9)		
Congenital anomalies	4	44.4
Hypertension	3	33.3
Diabetes mellitus	2	22.2
Duration by years on hemodialysis		
1- 3	8	22.9
4- 8	21	60.0
≥ 9	6	17.1
Mean±SD	**6.17± 3.19**	

Table (2) describes that about one quarter (25.7%) of the studied children were suffering from previous health problems and one third (33.3%) of these health problems was hypertension. Also, 60% of the children started hemodialysis from 4-8 years with the mean 6.17± 3.19.

Figure 2: Percentage distribution of the studied children regarding duration of hemodialytic session (n=35)

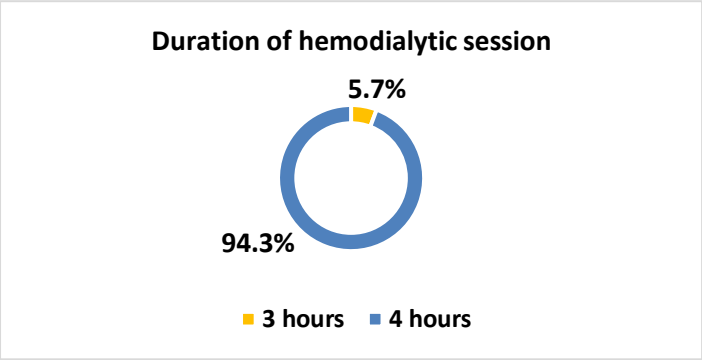

Figure (2) shows that the duration of hemodialytic session for the majority (94.3%) of children was 4 hours.

Figure 3: Percentage distribution of the studied children regarding occurrence of intrahemodialytic hypotension before and after implementing the guidelines (n=35)

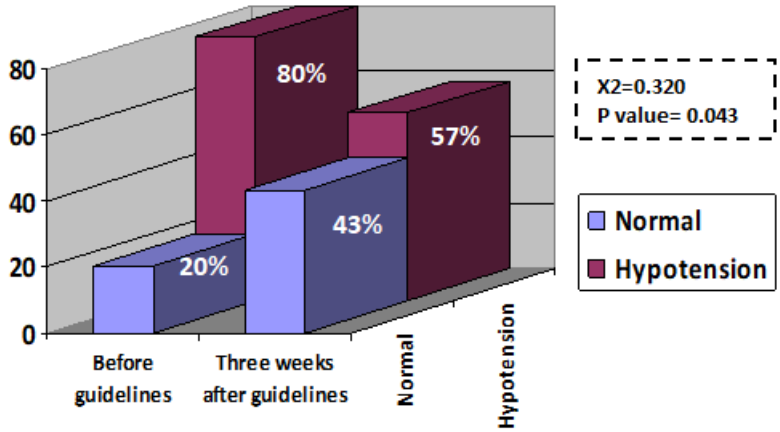

Figure (3) reveals that the majority (80%) of the studied children had hypotension during hemodialysis sessions before implementing the nursing guidelines and this percentage decreased to 57% after implementation of the guidelines. There was a significant improvement in their intrahemodialytic blood pressure before and after three weeks of implementation of the guidelines, where X2= 0.320 and p value=0.043.

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Figure 4: Percentage distribution of the studied children regarding occurrence of intrahemodialytic muscle cramps before and after implementing the guidelines (n=35)

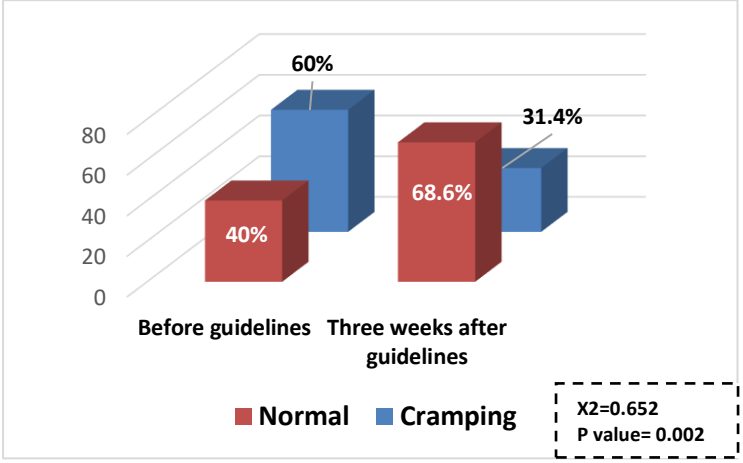

Figure (4) shows that more than half (60%) of the studied children had muscle cramps during hemodialysis sessions before implementing the guidelines and this percentage decreased to 31.4% after implementation of the guidelines. There was a highly statistically significant reduction in the frequency of muscle cramping after implementing the guidelines, where X2= 0.652 and p value=0.002.

Figure 5: Percentage distribution of the studied children regarding occurrence of intrahemodialytic hypoglycemia before and after implementing the guidelines (n=35)

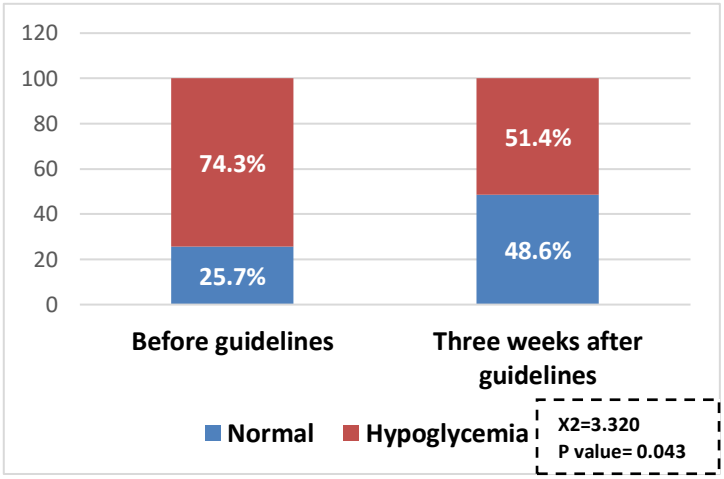

Figure (5) shows that slightly less than three quarters (74.3%) of the children had hypoglycemia during hemodialysis sessions before implementing the guidelines and this percentage decreased to 51.4% after implementation of the guidelines. There was a statistically significant reduction in the frequency intrahemodialytic hypoglycemia after implementation of the guidelines, where X2= 3.320 and p value=0.043.

IV. DISCUSSION

Regarding to sociodemographic characteristics of the studied children, the current study showed that more than three quarters of them are aged between 15 to 18 years. This result agrees with **(Mohammed, 2015)** who studied "The Effects of An Interventional Program Based on Self-care Model on Health Related Quality of Life Outcomes in Hemodialysis Children" and the results of the study described the age of the studied children as the majority of them were in school and adolescent stage and **(El Sayed et al., 2012)** in the study under the title "Effect of Nursing Intervention on The Quality of Life of Children Undergoing Hemodialysis" who found that the common age of children was between 12 and 18 years.

Concerning sex of the studied children, the current study showed that more than half of them were males. This finding is in the same line with **(Conger, 2017)** who found that chronic renal failure is much higher among males than females. On

the other hand, the finding disagrees with (Mahmoud, 2008) in the study titled "Needs Assessment of Children Undergoing Hemodialysis Therapy" and **(Abd El-Tawab, 2010)** in the study titled "Factors Affecting Quality of Life for Adolescent Undergoing Hemodialysis" whom found that more than half of children with hemodialysis were females.

Regarding residence of the studied children, the current study showed that slightly less than two thirds were living in rural areas. From the researcher point of view, this result may be due to that people who live in rural areas do not usually seek medical counseling and pay attention to their health as who live in urban areas. This result is supported by **(Hassan et al., 2012)** who studied "The Impact of Cryotherapy on Pain Intensity at Puncture Sites of Arteriovenous Fistula among Children Undergoing Hemodialysis" whose results revealed that more than half of children were males from rural areas and also, **(Zain El din et al., 2018)** who studied "Effect of Self-Care Model Intervention on Quality of Life of Children Undergoing Hemodialysis" and the findings showed more than half of children were living in village areas and the rest were from town.

As regard past medical history of studied children, the present study showed that about one quarter of them had past history of medical diseases and hypertension represents one third of these diseases. These results are in accordance with **(Hockenberry, Wilson 2018)** in the textbook titled "Wong's Nursing Care of Infants and Children" which illustrated that hypertension is the second most common cause of chronic kidney disease. In addition to that, these results are supported by **(Cohen, Townsend 2011)** who stated that hypertension frequently accompanies advancing chronic kidney disease, and it is often improperly assumed as the cause rather than the effect of chronic kidney disease.

Concerning duration by years on hemodialysis and duration of hemodialysis session, the current study illustrated that more than half of the studied children started hemodialysis from 4 to 8 years and the duration of hemodialysis session for the majority of them was 4 hours. From the researcher point of view, this may be due to most cases of renal failure occurs gradually over years and hemodialysis is a procedure that must be done with caution lasting 3 or 4 hours in order to avoid intrahemodialytic complications. These findings are supported by **(Zain El din et al., 2018)** whose findings showed that more than two thirds of children were on hemodialysis from 4 to 10 years and hemodialysis sessions for the majority of them are lasting for 4 hours. Also, these results are in the same line with **(Mukakarangwa et al., 2018)** in the thesis under the title "Adherence to Hemodialysis and Associated Factors Among End Stage Renal Disease Patients at Selected Nephrology Units in Rwanda: A Descriptive Cross-Sectional Study" which illustrated that more than one third and all of children are undergoing on hemodialysis for more than 5 years and have 4 hours hemodialysis sessions respectively.

In relation to children clinical outcomes regarding physical and physiological growth, the current study showed that there was a significant improvement in blood pressure of the studied children during hemodialysis sessions after implementing the guidelines. This result is supported by **(Palmer, Henrich 2008)** who illustrated that nursing practices including placing the patient in the Trendelenburg position, reducing ultrafiltration rate, continuous monitoring of blood pressure during dialysis session allowed for improvements in child's blood pressure.

Concerning the frequency of muscle cramping occurrence, the present study revealed that there was a highly statistically significant reduction in the frequency of muscle cramps that occur to children during hemodialysis after implementing the guidelines. This result is in accordance with **(Manjunathan, 2017)** in the study titled "A Study to assess the effect of intradialytic stretching exercise on muscle cramps among patients undergoing hemodialysis in a selected hospital at Bangalore" who concluded that exercises were effective in terms of reduction in the intensity, duration and frequency of muscle cramps in the controlled group. In addition to that, this result is supported by **(Lekha, 2016)** who showed that intradialytic stretching exercises help to prevent and reduce the muscle cramps during hemodialysis. Finally, the pediatric nurse must be alert and spend time to assess risk factors for muscle cramps, develop nursing strategies to prevent or reduce the incidence of muscle cramps during hemodialysis.

V. CONCLUSION

In the light of the study results, it was concluded that knowledge and practices of the studied nurses were improved after implementation of the evidence-based nursing guidelines which in turn improved the clinical outcomes of the studied children as reduction in the frequency of intrahemodialytic hypotension, muscle cramps and hypoglycemia.

VI. RECOMMENDATIONS

In the light of the current study findings, the following recommendations are suggested:

1. Periodic explanation and demonstration of evidence-based nursing guidelines for all nurses to improve clinical outcomes of children during hemodialysis sessions.
2. Inservice training programs should be conducted periodically and regularly for all nurses working in hemodialysis units.
3. Dialysis units should have a written policy about the standardized nursing care that should be delivered to every patient in the unit.

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