

## Effect of Evidence-based Practices on the Occurrence of Complications Related to Peripheral Intravenous Catheter for the Hospitalized Children

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### Abstract

**Background:** Evidence based practice is the process of decision-making during the patients' care, relying on verified research evidence and patients' opinions and traditions. The occurrence of PIVC's related complications continues to increase the need for raising the awareness and educating the nurses. **Research Design and Aim:** this study was a quasi experimental study aimed to evaluate the effect of evidence-based practices on the occurrence of complications related to peripheral intravenous catheter for the hospitalized children. **Setting:** the study was conducted at the pediatric medical inpatient department in Suez Canal University and Ismailia General Hospitals. **The sample:** included a convenient sample of all nurses (32) working in the above-mentioned settings and a purposive sample of (96) children divided randomly into two equal groups, each group involved (48) children who are satisfying predetermined inclusion criteria. Data were gathered using an assessment sheet and the PIVC complications' assessment sheet. **Results:** revealed that the total mean scores of PIVC related complications namely; phlebitis, infiltration, extravasation, infection and pain decreased in the study group compared to the mean scores in the control group. **Conclusion:** applying the evidence based practices of peripheral intravenous catheter care has decreased the occurrence and severity of its related complications namely; phlebitis, infiltration, extravasation, infection and pain. **Recommendation:** raising the awareness of nurses regarding the concept of EBP and its application in the prevention of PIVC's related complications through pamphlets, simple instructions or posters.

**Keywords:** Complications, Evidence based practices, Pediatric nursing -Peripheral intravenous catheter.

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### I. Introduction

Peripheral intravenous catheters are the routinely used invasive devices in pediatric health care settings in up to 60% of the pediatric patients who need preparatory emergent care. The care of peripheral intravenous catheters can be delivered in a safe and cost effective ways inside and outside of the hospital (**Wooten and Gallagher, 2016**).

Evidence-based practice (EBP) was described as the process of decision-making concerning performing procedures of the pediatric patients' care, which relies on modern, well-known and verified research evidence making accounts for the pediatric patients' opinions, traditions and societal expectation. Evidence-based practices, at the clinical setting, makes nurses integrate skills and professional information with new scientific evidence to identify the pediatric patients' problems and design the scheme of care, implement and evaluate those schemes (**Ashktorab et al., 2015**). The well identified PIVC's nursing care bundles involve; skillful PIVC's insertion, site inspection, maintenance of vein patency, scrubbing of the PIVC's hub and documentation (**Kleidon et al., 2019**).

Repeated peripheral intravenous catheter (PIVC) insertions make children susceptible to infections and non-infectious complications. These complications are minor and major categories according to the severity of symptoms (**Abolfotouh et al., 2014**).

## **II. Subject And Methods**

A quasi experimental design was used in this study to evaluate the effect of evidence-based practices on the occurrence of complications related to peripheral intravenous catheter for the hospitalized children.

### **Research Setting:**

Applying the evidence-based practices of peripheral intravenous catheter care will decrease the occurrence of its related complications in hospitalized children.

### **Research Setting:**

The study was conducted at the pediatric medical inpatient department in Suez Canal University and Ismailia General Hospitals.

### **Target population:**

A **convenient sample** of pediatric nurses (32) working in the above-mentioned settings regardless their characteristics. Data was collected over a period of six months.

**Tools of Data Collection:** (1) **Assessment sheet** that was designed by the researcher, involving the characteristics of the studied nurses and children, the inserted PIVC and nurses' knowledge regarding the EBP and PIVC in hospitalized children.

(2) **Peripheral intravenous catheter complications' assessment sheet**, the researcher developed this assessment sheet to evaluate the presence of any PIVC's related complications and its' severity in the control and study groups. Each child was evaluated throughout the first 48 hours of the PIVC insertion (every 12 hours). The PIVC complications' assessment sheet was consisted of five parts to assess phlebitis, infiltration, extravasation, infection and pain.

### **1. Administrative Design:**

An official permission was obtained through an issued written letter from the dean of the Faculty of nursing, Suez Canal University to the director of each study setting to seek their approval. The aim of the study & its' expected outcomes were illustrated.

### **2. Preparatory phase:**

A review of the past and current related literature regarding the different aspects of the research problem was carried out using books, periodicals, articles and websites to be acquainted with the research problem and to develop the study tools.

### **3. A pilot study:**

It was carried out involving 10% of the study sample. It was conducted over a period of one month starting from 15/3/2018 to 15/4/2018 to test the clarity and applicability of the study tools. After obtaining the results of the pilot study, ambiguous items were omitted, other items were added and others were modified and the final form was developed. The nurses included in the pilot study were excluded from the final study later.

### **4. Ethical consideration:**

Verbal consent was taken from each nurse and a child's mother prior to participation in the study after simple explanation of the aim and the expected outcomes of the study. The voluntary participation was assured.

### **5. Field work:**

The actual field work was carried out over a period of six months, starting from 15/5/2018 to 15/11/2018. The average time needed to fill the assessment sheet was about 45 minutes including about 15 minutes to assess the nurses' knowledge. The nurses' practices regarding the PIVC's care were assessed using observational checklists. The average time required for the completion of each checklist was 5 minutes.

#### **• Program implementation:**

The evidence based practice program was implemented over fourteen weeks involving (3) theoretical and (5) practical sessions for a group of nurses that entail 2-4 nurses. The duration of each session ranged from 30-60 minutes. The researcher was available by rotation 4 days (Sunday and Monday; Tuesday and Wednesday) per week in Suez Canal University hospitals and General hospital at Ismailia city respectively.

At introduction to the program and its aim was done. Feedback regarding the previous session was given at the beginning of each new session. The teaching methods utilized during the program were; modified lecture, group

discussion, demonstration and re-demonstration. The media included; hand out, power point presentation, posters, videos and real objects.

• **Program evaluation:**

The studied children's PIVCs were evaluated for the presence and severity of PIVC's related complications after 12, 24, 36 and 48 hours of its insertion in both the control and study groups.

**IV. Statistical design:**

Upon the completion of data collection, the gathered data was organized and coded prior to computer entry. The data were imported into statistical package for social sciences (SPSS version 20) for statistical analysis. Interpretation was conducted. Various statistical measures were used as; descriptive statistics as, frequency, distribution, means and standard deviations to describe the various variables of the study. Chi-Square and t-test were used to compare between different groups.

**III. Results**

**Table (1): Distribution of the studied nurses according to their socio-demographic characteristics (n=32).**

Socio-demographic characteristics	No.	%
<b>Age in years:</b>		
Less than 20	7	21.9
20<30	<b>18</b>	<b>56.2</b>
30≤40	7	21.9
<b>Mean ±SD</b>	26.4±2.3	
<b>Level of Education:</b>		
Diploma	10	31.3
Diploma with specialty	7	21.9
Technical institute	<b>11</b>	<b>34.4</b>
Bachelor of nursing sciences	4	12.5
<b>Years of experience:</b>		
Less than 6	<b>21</b>	<b>65.7</b>
6<12	8	25
12≤18	3	9.3
<b>Attendance of training courses concerning invasive procedures:</b>		
Yes	9	28.1
No	23	71.9

**Table (1)** showed that more than half of the studied nurses (56.2%) their age ranged between 20 to less than 30 years. More than one third (34.4%) of them were technical institute graduates. Nearly less than two thirds (65.7%) of them had less than 6 years of experience and almost less than three fourths of the studied nurses (71.9%) didn't attend any training courses regarding invasive procedure.

**Table (2): Distribution of the studied children according to their characteristics (n=48).**

Children's characteristics	Control group		Study group		t- test	P-value
	No.	%	No.	%		
<b>Age in months:</b>						
12<18	12	25	11	22.9	10.7	.002*
18<24	<b>19</b>	<b>39.6</b>	<b>20</b>	<b>41.7</b>		
24<30	7	14.6	6	12.5		
30≤36	10	20.8	11	22.9		
<b>Mean ±SD</b>	21.3±1.7		22.6±2.4			
<b>Gender:</b>					<b>X<sup>2</sup></b>	<b>P-value</b>
Male	<b>28</b>	<b>58.3</b>	<b>26</b>	<b>54.2</b>	3.56	0.43
Female	20	41.7	22	45.8		

**Table (2)** presents that, less than two fifths of the studied children (39.6%) age ranged between 18 to less than 24 months in the control group. While more than two fifths of the studied children (41.7%) their ages were between 18 to less than 24 months in the study group. As regards to the gender of the studied children, almost less than three fifths of them (58.3%) were males in the control group, whereas more than half of them (54.2%) were females in the study group.

**Table (3): Comparison between the PIVC related phlebitis in the studied children within 48 hours of the PIVC's insertion (n=96).**

Follow up of phlebitis/hours	Control group (n=48)	Study group (n=48)	t-test	P-value
12	1.15 ± 0.36	1.05 ± 0.2	2.33	<b>*0.02</b>
24	1.37 ± 0.57	1.04 ± 0.23	4.45	<b>*0.02</b>
36	1.81 ± 0.89	1.02 ± 0.33	5.14	<b>*0.01</b>
48	2.58 ± 0.92	1.0 ± 0.67	8.75	<b>*0.00</b>

**Table (3)** clarifies that, the total mean score of phlebitis decreased in the study group compared to the mean score in the control group. Differences of the 12, 24, 36 & 48 hours were statistically significant. Also the mean scores of the 36 & 48 hours were less than the scores of the first day (12 & 24 hrs) in the study group.

**Table (4): Comparison between the PIVC related infiltration in the studied children within 48 hours of the PIVC's insertion (n=96).**

Follow up of infiltration/hours	Control group (n=48)	Study group (n=48)	t-test	P-value
12	1.10 ± 0.31	1.04 ± 0.20	1.35	0.18
24	1.31 ± 0.47	1.06 ± 0.24	3.96	<b>*0.00</b>
36	1.75 ± 0.69	1.17 ± 0.38	5.27	<b>*0.02</b>
48	2.33 ± 0.97	1.37 ± 0.58	6.76	<b>*0.01</b>

**Table (4)** showed that, the total mean score of infiltration decreased in the study group compared to the mean score in the control group. Differences of the 24, 36 & 48 hours were statistically significant. However; the mean scores of the second day were more than the mean scores of the first day in the study group.

**Table (5): Comparison between the PIVC related extravasation in the studied children within 48 hours of the PIVC's insertion (n=96).**

Follow up of extravasation/hours	Control group (n=48)	Study group (n=48)	t-test	P-value
12	1.36 ± 2.26	1.15 ± 1.19	3.19	<b>*0.03</b>
24	2.79 ± 2.47	1.15 ± 0.92	4.72	<b>*0.02</b>
36	4.69 ± 2.6	0.85 ± 0.82	5.31	<b>*0.00</b>
48	4.98 ± 2.6	0.58 ± 0.13	6.24	<b>*0.00</b>

**Table (5)** illustrated that, the total mean score of extravasation decreased in the study group compared to the mean score in the control group. Differences of the 12, 24, 36 & 48 hours were statistically significant. Also the total mean scores of the second day were distinctively less than the mean scores of the first day in the study group.

**Table (6): Comparison between the PIVC related infection in the studied children within 48 hours of the PIVC's insertion (n=96).**

Follow up of infection/hours	Control group (n=48)	Study group (n=48)	t-test	P-value
12	0.92 ± 0.87	0.35 ± 0.53	4.89	<b>*0.03</b>
24	2.27 ± 1.19	0.85 ± 0.62	7.84	<b>*0.00</b>
36	3.83 ± 1.42	1.69 ± 1.07	9.9	<b>*0.02</b>
48	5.33 ± 1.63	2.15 ± 1.29	10.24	<b>*0.02</b>

**Table (6)** clarifies that, the total mean score of infection decreased in the study group compared to the mean score in the control group. Differences of the 12, 24, 36 & 48 hours were statistically significant. The total mean score of the 48 hours was more than the total mean score of the 12 hours in the study group.

**Table (7): Comparison between the PIVC related pain in the studied children within 48 hours of the PIVC's insertion (n=96).**

Follow up of pain/hours	Control group (n=48)	Study group (n=48)	t-test	P-value
12	0.61 ± 0.92	0.25 ± 0.64	3.02	<b>*0.00</b>
24	1.94 ± 1.58	0.75 ± 0.93	5.54	<b>*0.02</b>
36	3.13 ± 1.44	1.77 ± 0.92	5.95	<b>*0.02</b>
48	5.15 ± 1.95	2.79 ± 1.68	8.81	<b>*0.04</b>

**Table (7)** clarified that, the total mean score of pain decreased in the study group compared to the mean score in the control group. Differences of the 12, 24, 36 & 48 hours were statistically significant. The total

mean scores of the 36 & 48 hours of the study group were distinctively less than the total mean scores of the 36 & 48 hours in the control group.

#### **IV. Discussion**

Peripheral intravenous catheters are the routinely used invasive devices in up to 60% of pediatric patients who need preparatory emergent care. The care of peripheral intravenous catheters can be delivered in a safe and cost effective ways outside of the hospital (**Wooten and Gallagher, 2016**).

Nurses involved in the care of PIVCs must be competent in its assessment and care. The evidence recommended that continuous on job education should be provided about signs and symptoms of PIVC-related complications (**Fakih et al., 2012**).

Repeated peripheral intravenous catheter (PIVC) insertions make children susceptible to infections and other non infectious complications. Minor and major complications are categorized according to the severity of symptoms. Minor complications involve accidental removals, occlusions of the catheter, needle phobia and pain. While major complications include; infiltration, phlebitis, blood-stream infection, extravasation and skin injuries (**Abolfotouh et al., 2014**).

The results of the present study illustrated that, the mean age of the studied nurses was 26.4 years and more than half of them their age ranged between 20 to less than 30 years (**Table, 1**). Also **Mishelmovich et al., (2016)** in their study entitled as "Breaking significant news: the experience of clinical nurse specialists in cancer and palliative care", found that the nurses after years of clinical experience become more confident in delivering therapeutic care and communicating with patients.

Concerning the studied nurses' education, nearly more than one third of the studied nurses were technical institute graduates (**Table, 1**). This is explained by the fact that the main work force of the nursing staff in Egypt is constituted of diploma and technical institute graduates. However this finding was not on the same line with **Wilson et al., (2015)** in their study of "Empowering nurses with evidence-based practice environments: surveying magnet, pathway to excellence, and non-magnet facilities in one healthcare system" where they suggested that, many nurses worked in hospitals that adopt the excellence had a better EBP readiness, regardless of their education.

The current study clarified that, almost less than three fourths of the studied nurses didn't attend any training courses regarding invasive procedures (**Table, 1**). This finding was in agreement with a study entitled "Evaluating factors associated with implementing evidence-based practice in nursing", carried out by **Farokhzadian et al.,(2015)** who found that the majority (87.4%) of the nurses didn't attend any training about the subject. This may be due to the increased work activities of nurses.

The results of this study revealed that, more than half of the studied children were males in the control and the study groups (**Table, 2**). This was on the same line with a study describing "Lifespan and associated factors of peripheral intravenous cannula among infants admitted in public hospitals of Mekelle City, Tigray, Ethiopia, 2016" that was held by **Birhane et al.,(2017)** who found that half of the studied children were males.

Regarding the occurrence of phlebitis, in this study, the total mean score of phlebitis decreased in the study group compared to the mean score in the control group. Differences of the 12, 24, 36 & 48 hours were statistically significant (**Table, 3**). This finding may be due to the appropriate choice of vein, the frequent assessment and the use of an adhesive transparent dressing leading to prevention and earlier detection of phlebitis; these practices were strongly recommended in the evidence based PIVC educational program.

This result comes in the same line with a study entitled "Improving the visibility of intravenous (iv) site in pediatric patients to reduce iv site related complications—an evidence-based utilization project" held by **Lim et al., (2018)** where they carried out a project that has greatly improved the nurses' ability to monitor the IV site without having to remove any adhesive securements over the site or causing un-due stress to pediatric patients and thus decreasing the opportunity of developing the phlebitis. Also these findings were strictly supported by **Bonnici, (2012)** in their study describing "Safer patient care through better peripheral intravenous catheter management" where it was found that the rate of occurrence of phlebitis associated with PIVCs decreased significantly throughout the study from 22.7% in the pre-intervention period to 6.5% in the post-intervention period.

The present study illustrated that, the total mean score of infiltration decreased in the study group compared to the mean score in the control group and the differences of the 24, 36 & 48 hours were statistically significant (**Table, 4**). This result was on accordance to a study entitled "Implementing an evidence-based practice project in the prevention of peripheral intravenous site infiltrations in children" held by **Taylor, (2015)** who stated that the implementation of bedside-nurse training based on evidence and frequent assessments will reduce the risk for PIVC's site complications.

The current study illustrated that, the total mean score of extravasation decreased in the study group compared to the mean score in the control group. Differences of the 12, 24, 36 & 48 hours were statistically significant (**Table, 5**). This was due to proper fixation and maintenance of the PIVC was stressed during

evidence based training program implementation. This result was supported in a study entitled "When in doubt, pull the catheter out: implementation of an evidence-based protocol in the prevention and management of peripheral intravenous infiltration/extravasation in neonates" carried out by **Desarno et al., (2018)** who mentioned that, the consequences of extravasation may be prevented by implementing an evidence based practice guideline for extravasation prevention and management.

The present study clarified that, the total mean score of infection is much less in the study group than the mean score in the control group (**Table, 6**). This result may be due to the infection control practices that were emphasized and adopted during the implementation of the training program. This result was on accordance to a study of "Safer patient care through better peripheral intravenous catheter management", held by **Bonnici, (2012)** who depicted that the incidence of developing PIVC related infections was 3.47 times higher in the pre-intervention period than the post-intervention period.

As observed during the present study, the total mean score of pain is low in the study group compared to the mean score in the control group. Differences of the 12, 24, 36 & 48 hours were statistically significant (**Table, 7**). This may be due to the use of multiple distraction techniques as "therapeutic play" to decrease the procedural pain and the continuous monitoring for the PIVC adverse events that caused the pain. Another study describing "An evidence-based approach to minimizing acute procedural pain in the emergency department and beyond", held by **Ali et al., (2016)** who emphasized the effectiveness of distraction techniques in infants and young children with or without the use of topical anesthetic creams.

## V. Conclusion

In the light of the current study, it can be concluded that, applying the evidence based practices of peripheral intravenous catheter care has decreased the occurrence and severity of its related complications as: phlebitis, infiltration, extravasation, infection and pain.

## VI. Recommendations

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

1. Raising the awareness of nurses regarding the concept of EBP and its application in the care of PIVC through pamphlets, simple instructions or posters.
2. Applying training programs for the nurses regarding evidence based practices and its' application in the patients' care.
3. Further researches should be carried out to implement innovative up-to-date nursing measures to prevent the PIVC related complications.

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