

Original

Intravenous Infiltration and Extravasation Prevention: Nurses` Practice at Pediatric Hospitals in Khartoum State

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Abstract

Background: Prevention is the best method for decreasing morbidity from peripheral intravenous infiltrations and extravasation. Infiltration and extravasation are complications of intravenous therapy involving unintended leakage of solution into the surrounding tissue. Consequences range from local irritation to amputation. The aim of this study isto study nurses` performance about intravenous infiltration and extravasation.

Method: Descriptive cross-sectional, hospital based-study. Study conducted at four pediatric hospitals in Khartoum state. 165 nurses were included using Stratified random sample to select the nurses of different working experience. Data was collected by an observational check list and analyzed by statistical packages of social sciences SPSS version 20.

Results: Finding illustrated that (47.9%) of participants inserted cannula from first attempt , (20%) of participants flushed cannula with distilled water ,to assess function of cannula, all participants in present study covered the insertion site with non-transparent plaster, more than half (57.6%) dilute vesicant medication with less amount than required. There was a statistical significant association with qualifications (p value 0.001).

Conclusion: The study concluded that nurses had poor level of practice on intravenous infiltration and extravasation.

Keywords: Extravasation, Intravenous infiltration, Prevention, Performance

Introduction

Nurses are expected to maintain competence in peripheral intravenous site care to enhance the best patient outcomes and prevent potentially life-threatening complications; it is a technically difficult and complicated procedure that needs to be performed successfully (1). Intravenous infusion therapy is associated with many complications including infiltration and extravasation (2). Intravenous infiltration is the leakage of a non-vesicant solution into the surrounding tissues and extravasation is the inadvertent leakage of a vesicant solution into surrounding tissues. Vesicant refers to any medication or fluid with the potential of causing blisters, severe tissue injury or necrosis. The concentration of vesicant, the amount extravasated, and the type of vesicant are all factors which will influence the severity of the extravasation. Prevention of infiltration and extravasation begins with choosing an appropriate IV gauge, careful site selection, frequent visual assessment, patency of vein, compare the appearance of the two extremities and recognize signs and symptoms of infiltration and extravasation. Site selection should avoid areas of flexion; areas of pain on palpation. Peripheral or central venous

access devices shall be flushed before each infusion as a part of the steps to assess catheter and preventing contact between incompatible medications (3). The intravenous cannula site should be covered with a transparent dressing which assists security of the site, as well as allowing the site to be visible at all times (4). Tape or plaster should not be wrapped around the extremity as this could also form a tourniquet effect (5). A lot of practitioners peripheral intravenous catheter knowledge and insertion skill deficits have been identified, including patient assessment, insertion site selection, catheter selection and insertion, catheter securement, dwell time, complication identification and treatment, and compliance with best practice guidelines and need for effective education strategies (6). In 2012, INS released a position paper on the frequency of assessing peripheral catheter sites. Observations of the insertion site is recommended at a frequency of every 1 to 2 hours assessment based on the type of fluids and medications being given (7). Center for disease control and prevention Guidelines for the Prevention of Intravascular Catheter-Related Infections recommended that replacing peripheral catheters in children should be done only when clinically indicated (8).

Accurate documentation of the infiltration and extravasation is crucial to facilitate patient care and in case of litigation. Documentation is the keys to an effective legal defense in the event of a medicolegal claim (9). The outcome from infiltration and extravasation can range from edema in an extremity to full-thickness skin loss, muscle or tendon necrosis, and in some cases, even amputation (10). In addition it also led to prolonged hospitalization and increased medical costs (11). It is important for nurses to improve practice and knowledge through specific education and training. This provides high quality and effective health care for patients (12). It is important to assess the ability of nurses to create positive change in the knowledge and practice. The number of researches regarding intravenous infiltration and extravasation among children in Sudan are limited. Therefore, this study aims to study nurses' performance regarding prevention of infiltration and extravasation in pediatric hospital.

Methods:

A Descriptive cross- sectional, hospital based- study was conducted at the main pediatric governmental hospitals in Khartoum state, Ahmed Gasim pediatric hospital, Mohammed Elamin Hamid

Pediatric Hospital, Gafaar Ibn uof Pediatric Referral Hospital and ALbluck Pediatric Hospital.

The sample size was calculated used the following equation:

$$n = \frac{N}{1 + (N-1) e^2}$$

n : is the desirable sample size

N: is the total population size

e: is the degree of accuracy desired (the accepted margin of error and is usually set to 0.05)

$$n = \frac{280}{1 + (280-1) 0.0025} = \frac{280}{1.70} = 164.7$$

The sample size of this study were 165 nurses by using above formula

Stratified random sample technique was used to select the samples.

Table 1: Proportion used to determine the sample size of nurses from each hospital as:

Hospital	Population	Proportion %	Sample size
Ahmed Gasim Children's Hospital	50	18 %	29
Mohammed Elamin Hamid Children's Hospital	130	46%	77
GafarIbn Auf Children's referral Hospital	44	16 %	26
ELbuluk Children's Hospital	56	20%	33
Total number of nurses	280	100%	165

Each staff name was given a number according to their frame in hospital, and then the names listed in the separated numeric list to any hospital, then numbers collected and selection done randomly to decide participants included in the study according to the proportion of hospital from the total sample size.

Variables under study were size of cannula, selection of site, flushing, secure of insertion site documentation of cannula insertion, and touch look compare TLC method. Data was collected by an observational check list for practical skills related to preventive measures of infiltration

and extravasation based on Infusion Therapy Standards of Practice and analyzed by statistical packages of social sciences SPSS version 20. The practical skills scored from one to three, 3 being good if skill done, 2 for fair if skill not done correctly and 1 for poor if skill not done. Data presented in form of simple frequency table and cross table to explore the relationship between variables. P value ≤ 0.05 was considered statistically significant. Ethical approval was obtained from ethical committees and administrative authorities of hospitals.

Results:**Table 2:** Characteristics of the study population N=165

Demographic	Frequency	Percentage
Age groups		
20-30 years	11	6.70%
31-40 years	92	55.80%
41-50 years	39	23.60%
> 50 years	23	13.90%
Nurses qualifications		
Ordinary nurse	57	34.50%
Diploma	71	43.00%
Bachelor	31	18.80%
Master	6	3.60%
Gender		
Male	30	18.20%
Female	135	81.80%
Years of Experience		
1-5 years	11	6.70%
6-10 years	31	18.80%
11-15 years	86	52.10%
> 15 years	37	22.40%
Total	165	100%

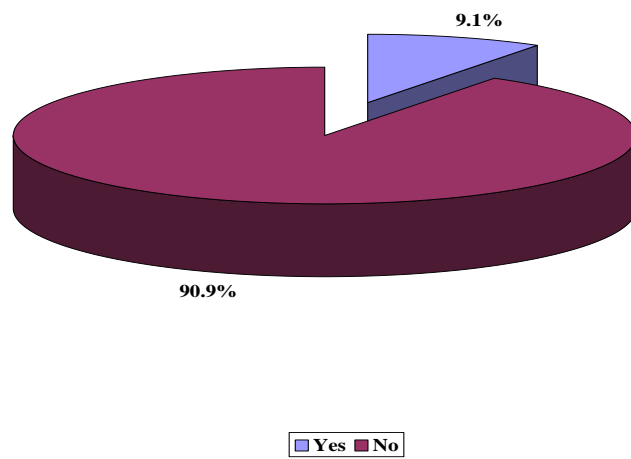


Figure 1. Previous training in complication of intravenous therapy N=165

Table 3: The association between qualification and assess cannula function by flushing 0.9% saline

Qualification		Not done	Done not correctly	Done correctly	Total
Ordinary nurse	count	57	0	0	57
	%	0%	0%	0%	100%
Diploma	count	36	29	6	71
	%	50.7%	40.8%	8.5%	100%
BSC	count	24	3	4	31
	%	77.4%	9.7%	12.9%	100%
Msc	count	3	1	2	6
	%	50%	16.7%	33.3%	100%
Total	count	120	33	12	165
	%	72.7	20	7.3%	100%

P Value =0.001

Table 4: Distribution of the studied nurses` practice about preventive measures of IV infiltration and extravasation n=165

Items	Not done		Done not correctly		Done correctly	
	N	%	N	%	N	%
Select the smallest-gauge	64	38.8	00	00	101	61.2
Avoid area of flexion	135	81.8	00	00	30	18.2
Insertion of cannula from first attempt	86	52.1	00	00	79	47.9
Start from distal to proximal	68	41.2	46	27.9	51	30.9
Assess catheter function by flushing 0.9% saline	120	72.8	33	20	12	7.2
Insertion site visible with transparent plaster	165	100.	0.0	0.0	0	0.0
Plaster tape not circumferential	121	73.3	40	24.2	4	2.5
Monitoring site hourly for edema and discoloration	112	67.9	49	29.7	4	2.4
Documentation of cannula insertion	165	100.0	0	0	0	0.0
Dilute vesicant medications appropriately before administration	0	0	95	57.6	70	42.4
Flushed cannula after each infusion to clear the infused medication	162	98.2	0.0	0.0	3	1.8
Perform TLC hourly: touch site (for coolness ,pain swelling, blanching, blister at the insertion site, Compare both extremities every hour	165	100.0	0.0	0.0	0.0	0.0

Significant P value 0.001

Discussion

The study showed that a few nurses received training on intravenous complications, contrary to the study conducted by Ajani K, which emphasizes the importance of education and training.(11).Findings revealed that, most of the nurses used the smallest size cannula 24 gauges more frequently. Similar to a study done by Alexander MA, small gauge catheters result in fewer vein traumas (3).Approximately fifth of nurses inserted cannula from distal to proximal, starting distally saves more proximal veins for future use, most of the participants used antecubital area, most of the participants did not avoid area of flexion, and this site is easily accessible although INS standards recommended avoiding area of flexion due to a higher failure rate. Furthermore, 20 percent of nurses flush peripheral cannulas with sterile water, which is an incorrect practice. Sterile Water for Injection, unique selling proposition (USP) is a hemolytic agent and contraindicated for intravenous use (13).A lack of nurse supervision and a lack of policies and guidelines during intravenous therapy contributed to this finding .Most of the nurses did not know that using distilled

water for IV flushing causes hemolysis of RBCs. This may be attributed to the fact

that participants did not emphasize on updating their knowledge and practice. In the present study, all nurses covered the insertion site with nontransparent plaster, which was not consistent with Lim EYP's report that a transparent plaster allow visibility of site (14). Transparent plaster enables visual inspection of the cannula site, and leads to early detection of infiltration and extravasation. Transparent plasters were not available in children's hospitals during the study. In the study, it was found that most nurses applied plaster tape circumferentially rather than the study by Amjad that reported that the circumferential tape had a tourniquet effect. A tight tape could worsen infiltration effects. Nurses thought this method fix cannula in place.(5)A few nurses monitored the insertion site hourly for signs of edema and discoloration, which is in conflict with Gorski LA's recommendation of monitoring the insertion site every one to two hours depending on the type of fluids and medications used(7). If the nurse does not monitor the insertion site; this indicates low quality of care, and late detection of infiltration .Some hospitals had a shortage

of staff and some nurses disregarded their role. The nurses in the study failed to document the insertion of the cannula, which is inconsistent with Raveesh B's study in which documentation is crucial to an effective legal defense in medical malpractice cases. Approximately half of nurses dilute medications with less than the amount required, and the concentration of vesicant influences the severity of extravasation. This is not similar to the study done by Amjad I which reported that staff should inform the pharmacy when using a short peripheral cannula so that dilutions can be adjusted accordingly.

This study revealed that the entire participants did not document insertion of cannula, this not in context with study conducted by Raveesh B (9). The nurses should insist to write what they do through supervision, especially in the event of a medico-legal claim .More than half of nurses dilute medications with less amount than required, concentration of vesicant is factor influence the severity of the extravasation. This not similar to study done by Amjad I reported that staff should notify the pharmacy when using short peripheral cannula so that dilution can be adjusted for administration.(5) At Pediatric hospitals in Khartoum state ,the use of short peripheral

cannula was common and nurse is the one mixing and diluting medication not pharmacist. The current study showed differences in level of the practice scores with regard to nursing qualification p-value 0.001 .

Conclusion & Recommendations:

This study concluded that performance of nurses in prevention of infiltration and extravasation was poor. This study recommends standard for infusion therapy and guideline. Supervisory system should be created to ensure best practice .

Conflict of interest

The authors have stated explicitly that there are no conflicts of interest in connection with this paper. The authors alone are responsible for the content and writing of the paper.

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References:

1. Lyons, M.G., Kasker, J Outcomes of a continuing education course on intravenous catheter insertion for experienced registered nurses. pubmed [Internet]. 2012Apr

- 43(4):177–81. Available from: ncbi.nlm.nih.gov/pubmed/22074216[cited 2017Mar];
2. Thomas J. Standard practice and evolving trends in pediatric intravenous access. *Air Medical Journal*. 2007;26(1):8–11.
 3. Alexander M. Infusion Standards. *Journal of Infusion Nursing*. 2016;39(4):181–2.
 4. Lim EYP, Wong CYW, Kek LK, Suhairi SSBM, Yip WK. Improving the Visibility of Intravenous (IV) Site in Pediatric Patients to Reduce IV Site Related Complications – An Evidence-based Utilization Project. *Journal of Pediatric Nursing*. 2018;41.
 5. Amjad I, Murphy T, Nylander-Housholder L, Ranft A. A New Approach to Management of Intravenous Infiltration in Pediatric Patients. *Journal of Infusion Nursing*. 2011;34(4):242–9
 6. Hadaway L. Short Peripheral Intravenous Catheters and Infections. *Journal of Infusion Nursing*. 2012;35(4):230–40
 7. Gorski LA, Hallock D, Kuehn SC, Morris P, Russell JM, Skala LC. Recommendations for frequency of assessment of the short peripheral catheter site .*Journal of Infusion Nursing* .2012; 35(5):290-292.
 8. Center for disease control and prevention. Guidelines for the Prevention of Intravascular Catheter-Related Infections 2017
 9. Raveesh B, Nayak R, Kumbar S. Preventing medico-legal issues in clinical practice. *Annals of Indian Academy of Neurology*. 2016;19(5):15.
 10. Roth D. Pediatric Infiltration and Extravasation. *Journal of the Association for Vascular Access*. 2006;11(1):14.
 11. Woody G, Davis BA. Increasing Nurse Competence in Peripheral Intravenous Therapy. *Journal of Infusion Nursing*. 2013;36(6):413–9.
 12. Ajani K, Moez S. Gap between knowledge and practice in nursing. *Procedia - Social and Behavioral Sciences*. 2011; 15:3927–31.
 13. U.S. Pharmacopeial Convention. USP chapter <1231> water for pharmaceutical purposes. In: USP 39–NF 34. Rockville, MD: U.S. Pharmacopeial Convention; 2016
 14. Lim EYP, Wong CYW, Kek LK, Suhairi SSBM, Yip WK. Improving the Visibility of Intravenous (IV) Site in Pediatric Patients to Reduce IV Site Related Complications – An Evidence-based Utilization Project. *Journal of Pediatric Nursing*. 2018; 41.