

Effect of Execution of the Peripheral Intravenous Cannula Care Bundle on Reducing the Incidence of Infection

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Abstract

Background: Today the insertion of peripheral intravenous cannulas is a common practice in hospitals, however local and systemic complications may be raised because of presence of such cannulas in situ.

Aim: The aim of this study was to evaluate the effects of execution of the peripheral intravenous cannula care bundle on reducing the incidence of infection.

Methods: this study was carried out in a Critical Care and Convalescence Unit at Mansoura Main University Hospital with 60 patients who have had a peripheral intravenous cannula and all staff nurses who are working at the previously mentioned setting and willing to participate in the study.

Results: The results noted that, the overall compliance of nurses regarding peripheral intravenous cannula care bundle was 70 % in both insertion and ongoing care actions post-education, which was significantly improved compared to pre-education. In addition, the presence of microorganisms was 46.7% pre-education compared to 3.3% post education which was highly statistically significant ($P < 0.001$).

Conclusion: Adoption of the simple, inexpensive, and evidence-based peripheral intravenous cannula care bundle is the best approach to prevent complications of peripheral intravenous cannula in the future.

Keywords: care bundle, peripheral cannula, infection, incidence

Date of Submission: 07-10-2017

Date of acceptance: 18-11-2017

I. Introduction

The insertion of peripheral venous catheters (PVC) is the most common invasive procedure among patients admitted to hospital. However, PVCs are not without complications. These complications are local and systemic. Local complications include phlebitis which is manifested by tenderness and redness at tip of cannula and along vein, Extravasation which is manifested by swelling at and above I.V. site, discomfort and tight feeling, blanching, decreased skin temperature at site and continuing fluid infusion even when vein is occluded, cannula dislodgement which may be caused by loosened tape or pulling out of the cannula by confused patient and occlusion, which is manifested by difficult infusion flow is a common complication of PVC. (Ricchia, M., et al, 2005 and Sriupayo, A., et al, 2014).

Systemic complications include systemic infection, allergic reaction, circulatory overload and air embolism. (McCann, J., et al, 2004) Cannula-related blood stream infections are caused by microorganisms – including Staphylococcus epidermidis, Staphylococcus aureus, Candida species and Enterococci which introduced within contaminated infusion fluid. (Boyd, S., et al, 2011) Most previous studies reported the risk factors of PVC complications, which comprised patient characteristics, therapy administered, practice of health professionals, and materials used. Nurses, in particular, have important responsibilities in intravenous cannula application. Poor nurse compliance with care regarding PVC is leading to serious events of infectious complications (Sriupayo, A., et al, 2014).

In order to avoid all these complications, registered nurses must ensure their information and practices related to the managing of peripheral venous cannulas are highly developed and evidence based as they are responsible for assessing and preparing the patient before the insertion of peripheral cannula, care and maintenance of the cannula and preventing the development of complications (Boyd, S., et al, 2011).

Peripheral vascular cannula care bundle is a high impact intervention used to reduce the incidence of peripheral intravenous cannula infection. This care bundle is based on EPIC guidelines, expert advice and other national infection prevention and control guidance. The care bundle is a collection of excellent practices combined together by empirical evidence into a single package, which standardizes administration and monitoring practices, and results in better patient care. (**Department of Health, 2008**). According to the literature, the care bundle decreases complications and length and cost of hospital stay. The bundle was developed for PVC care by the Health Protection of Scotland, and following PVC care bundle standards provides good practice and decreased complications. (**Sriupayo, A., et al 2014**).

Aim Of The Research Study

To evaluate the effectiveness of execution of the peripheral intravenous cannula care bundle on reducing the incidence of infection.

Research hypothesis

The incidence of peripheral intravenous cannula infection will be reduced in patients who are followed by the peripheral intravenous cannula care bundle in comparison to patients who are not followed by this intervention.

II. Methodology

Material

Design:

A quasi-experimental research design will be utilized to conduct the study.

Setting:

The study will be conducted at the Critical Care and Convalescence Unit at Mansoura Main University Hospital. It included two floors, each floor has five rooms with six beds each, and the most common diagnosis of patients is (ischemic stroke).

Subjects:

The subjects of the current study composed of two groups, **group I**, a convenient randomly assigned sample composed of 60 adult patients aged from 20 to 60 years of both sexes who were admitted to the previously mentioned setting and will have a peripheral intravenous cannula. They were divided into two equal groups, group A (control group) and group B (study group). **Group II**, this group consisted of all staff nurses who are working at the previously mentioned setting and willing to participate in the study.

Tools: The tools of the study were arranged into three main tools:

Tool I:

" Peripheral intravenous cannula assessment sheet "

This tool was developed by the researchers after reviewing the related literature (**ZinggW, 2009**) to assess criteria related to peripheral intravenous cannulas. It was concerned with peripheral intravenous cannula characteristics such as site of insertion, time of insertion, duration of cannula placement, signs of exit-site infection as (redness, tenderness, erythema, pain and purulence), signs of cannula occlusion, and reason of cannula removal.

Tool II:

" Peripheral intravenous cannula care bundle observational checklist"

This tool was adopted from (**Department of health, 2011**). It aimed to assess the performance of every appropriate action of the peripheral intravenous cannula care bundle as a pretest of nurses before providing the educational session. On the other hand, the same tool was used to evaluate the performance of every appropriate action of the peripheral intravenous cannula care bundle every time it is needed and achieve 100% compliance with the care bundle as a posttest of nurses after providing the educational session. It was composed of items related to insertion action as aseptic technique, hand hygiene...etc and ongoing care actions such as site inspection and dressing...etc.

Scoring System of the tool

- When a care bundle action is performed, insert a Y in the relevant column. If the action is not performed, insert an N in the relevant column.
- When the care action is not performed, as it is not applicable insert an N/A.
- Calculate the totals and compliance levels manually.
- The "all actions performed" column should be filled with a Y when all the appropriate actions have been completed on every required occasion.

- Where actions have not been performed, overall compliance will be less than 100%. This provides immediate feedback for users on those care bundle actions not completed, and action can then be taken to improve compliance levels.

Tool III:

" Peripheral intravenous cannula care bundle evaluation sheet"

This tool was developed by the researchers after reviewing the related literature (**Stuart RL, Grayson ML, Johnson PD, 2013**) to assess the effect of the peripheral cannula care bundle on reducing the occurrence of infection and it included two parts:

Part 1: Peripheral intravenous cannula exit site infection

This part was used to assess the signs of peripheral intravenous cannula exit site infection for both groups pre and post application of peripheral intravenous cannula care bundle as (redness, tenderness, erythema, pain and purulence).

Part 2: Peripheral intravenous cannula signs of cannula occlusion

This part was used to assess signs of Peripheral intravenous cannula occlusion such as, the presence of any change in the ability to infuse or withdraw intravenous fluids or presence of visible clots in the external portion of the cannula.

Part 3: Peripheral intravenous cannula bacteriological examination "

This part was used to compare the cultures obtained from the tip of cannulas of both groups pre and post application of peripheral intravenous cannula care bundle.

Methods

- 1- Official written permission to conduct the study was obtained from the responsible authorities at Critical Care and Convalescence Unit at Mansoura Main University Hospital, after explanation of the aim of the study.
- 2- The tools were developed after reviewing the related literature.
- 3- A pilot study was conducted on 10% of sample to test the applicability of the tools. Appropriate modifications were done prior to data collection for the actual study.
- 4- Once the necessary approval was granted to proceed with the proposed study, data was collected using the designed study tools.
- 5- Human rights and ethical considerations were kept.

The research process includes the following phase:

- **Assessment phase**

During this phase, the researchers gathered the baseline data from all available patients who have recent insertion of peripheral intravenous cannula and was considered control group through "**peripheral intravenous cannula assessment sheet "**. In addition, bacteriological examination was done through cultures obtained from the tip of the cannulas immediately after removal of it. On the other hand, during this phase, the researchers assessed the routine nursing care regarding insertion and ongoing care of peripheral intravenous cannula using tool II

Operational phase (teaching session)

During this phase, the researchers provided a teaching session regarding peripheral intravenous cannula care bundle to the nurses allotted to the study. It had been one teaching session for a period of 3 hours. The researchers talked about how to use peripheral intravenous cannula care bundle during insertion of peripheral intravenous cannula such as aseptic technique, hand hygiene, personal protective equipment, skin preparation, dressing and documentation. They also talked about peripheral intravenous cannula care bundle during ongoing care actions of peripheral intravenous cannula such as hand hygiene, continuing clinical indication, site inspection, dressing, cannula access, and administration set replacement, cannula replacement and documentation.

Implementation phase

The researchers evaluated nurses' performance regarding insertion and ongoing care of peripheral intravenous cannula through care bundle which based on teaching session, using tool II ("**peripheral intravenous cannula care bundle observational checklist**"), bacteriological examination will be done through cultures obtained from the tip of the cannulas (after 72hrs) of insertion from all available patients that were considered (study group).

Evaluation phase

During this phase, the researchers evaluated the effect of implementing care bundle on reducing the prevalence of peripheral cannula infection using tool III (part 1&2).

III. Statistical Analysis

Data was collected, coded, organized, categorized, and then transferred into especially designed formats. The statistical analysis of data was done by using SPSS program (statistical package for social science). The data was tabulated and presented. The description of the data was done in form of mean and standards deviation for quantitative data, frequency and proportion for qualitative data. The analysis of the data was performed to test statistical significant difference between variables for both groups (study and control). For quantitative data, mean and standards deviation were used. T- test was used to compare between 2 variables. For qualitative data (frequency and proportion), Chi- square test was used.

IV. Results

The results of the current study were presented in five tables as follow:

Table I: Distribution of the study sample according to nurses' characteristics:

	n	%
Educational level		
Diploma degree	18	60%
Baccalaureate degree	12	40%
Years of experience		
<5 years	9	30%
5 – 10 years	18	60%
>10 years	3	10%
Previous training courses attendance on peripheral cannula care bundle	6	20%

Table (I): shows the distribution of the study sample according to nurses' characteristics: it can be noted that more than half of the study sample had diploma degree. Regarding years of experience, 60% of the nurses worked from 5 to 10 years in the critical care and convalescence hospital. Regarding attendance of previous training courses on peripheral cannula care bundle, it can be seen that only 20% of the nurses had previous training.

Table II. The frequency of peripheral cannula characteristics

	n	%
Site of cannula insertion		
Median cubital	19	63.3
Basilic vein	5	16.7
Cephalic vein	5	16.7
Hand	1	3.3
Duration of cannula placement		
1 day	1	3.3
2 days	4	13.3
3 days	17	56.7
4 days	8	26.7
Cannula gauge		
16	8	26.7
20	6	20
22	13	43.3
18	3	10
Reason for inserting the cannula		
Administration of intravenous fluids	2	6.7
administration of intravenous fluids and medications	28	93.3

Table (II): describes the frequency of peripheral cannula characteristics, it can be seen that the most common site for inserting the peripheral cannula was the median cubital vein in the forearm. Regarding duration of cannula placement, it can be noted that nearly half of the cannulas were placed in situ for 3 days. As regards to cannula gauge, size 22 was used in 43.3 %. Administration of intravenous fluids and medication was done through 93.3 % of the peripheral cannula.

Table III. Frequency of nurses compliance with peripheral vascular cannula care bundle elements

Insertion Actions	Pre	Post-education					Chi square test
		Ob1	Ob2	Ob3	Ob4	Ob5	

Hand hygiene	n	5	30	30	30	30	30	X ² =145.161
	%	16.7	100	100	100	100	100	P<0.001
Personal protective equipment	n	5	30	30	30	30	30	X ² =145.161
	%	16.7	100	100	100	100	100	P<0.001
Skin preparation	n	2	30	30	30	30	30	X ² =165.789
	%	6.7	100	100	100	100	100	P<0.001
Dressing	n	22	30	30	30	30	30	X ² =41.86
	%	73.3	100	100	100	100	100	P<0.001
Documentation	n	12	30	23	23	21	23	X ² =28.636
	%	40	100	76.7	76.7	70	76.7	P<0.001
Ongoing Care Actions								
Hand hygiene	n	0	26	30	30	30	30	X ² =157.373
	%	0	86.7	100	100	100	100	P<0.001
Continuing clinical indication	n	2	25	28	30	30	23	X ² =105.839
	%	6.7	83.3	93.3	100	100	76.7	P<0.001
Site inspection	n	14	30	29	29	22	22	X ² =42.063
	%	46.7	100	96.7	96.7	73.3	73.3	P<0.001
Dressing	n	10	30	29	30	30	22	X ² =80.114
	%	33.3	100	96.7	100	100	73.3	P<0.001
Cannula access	n	8	28	30	30	30	30	X ² =113.077
	%	26.7	93.3	100	100	100	100	P<0.001
Administration set replacement	n	8	26	29	30	23	30	X ² =77.744
	%	26.7	96.7	96.7	100	76.7	100	P<0.001
Cannula replacement	n	18	30	30	23	23	22	X ² =24.658
	%	60	100	100	76.7	76.7	73.3	P<0.001
Documentation	n	0	30	30	23	23	22	X ² =99.195
	%	0	100	100	76.7	76.7	73.3	P<0.001

Table (III): Illustrates the frequency of nurses compliance with peripheral vascular cannula care bundle elements: it was noted that hand hygiene, wearing personal protective equipment was done by 16.7 % pre-education compared to 100% post education which was statistically significant (P<0.001), skin preparation was done by only 6.2% pre-education compared to 100% post-education which was statistically significant P<0.001), as regards to dressing as an insertion action of peripheral cannula, it was done by 73.3% of nurses pre-education compared to 100% post- education which was statistically significant P<0.001). 40% of nurses performed documentation as an insertion action pre-education compared to 100% in first observation post-education, 76.7%, 76.7%, 70% and 76.7% in 2nd, 3rd, 4th and 5th observations respectively. As regards to ongoing care actions, hand hygiene, Continuing clinical indication, site inspection, dressing, cannula access, administration set replacement, cannula replacement and documentation was significantly improved post- education of peripheral intravenous cannula (P<0.001).

	Insertion actions		Ongoing care actions		All actions		Chi square test	
	n	%	n	%	n	%	X ²	p
Pre-education	0	0	0	0	0	0		
Post-education								
Ob 1	30	100	21	70	21	70	10.588	<0.001
Ob 2	23	76.7	26	86.7	19	63.3	1.002	0.317
Ob 3	23	76.7	22	73.3	22	73.3	0.089	0.765
Ob 4	21	70	22	73.3	20	66.7	0.082	0.775
Ob 5	23	76.7	22	73.3	22	73.3	0.089	0.765
Over all compliance	21	70	21	70	19	63.3		
Chi square test X ²	10.000		2.727		1.066			
P	0.040		0.604		0.899			

Table (IV): shows the frequency of nurses who had performed the complete and correct insertion and ongoing care actions pre and post education, it was noted that all nurses complete all insertion actions post education, which was noted in observation number 1. The overall compliance was 70 % in both insertion and ongoing care actions which was significantly improved.

	Pre		Post		Chi square test	
	n	%	n	%	X ²	p

Exit site infection						
Redness	11	36.7	4	13.3	4.356	0.037
Pain	6	20.0	0	0.0	6.667	0.010
Erythema	2	6.7	0	0.0	2.069	0.150
Tenderness	5	16.7	0	0.0	5.455	0.020
Inflammation	12	40.0	1	3.3	11.882	<0.001
Cannula occlusion	3	10.0	0	0	3.158	0.076
Change in the ability to infuse or withdraw	8	26.7	0	0.0	9.231	0.002
Presence of organism	14	46.7	1	3.3	15.022	<0.001
Type of organism						
E. coli	4	28.6	0	0.0		
Staphylococcus	9	64.3	0	0.0		
Diphtheroid	1	7.1	1	100.0	6.964	0.031
Count of Collected Organisms (x10³)						
<17	3	21.4	1	100.0		
17 - <80	3	21.4	0	0.0		
80 - <100	1	7.1	0	0.0		
>100	7	50.0	0	0.0	2.946	0.040

Table (V): shows the comparison of frequency of complications pre and post-implementation of the cannula care bundle: it was noted that inflammation at cannula site was significantly decreased post care bundle education ($P<0.001$). The difficulty to infuse or withdraw from the cannula was decreased significantly post education ($p\ 0.002$). The presence of microorganisms was 46.7% pre-education compared to 3.3% post education which was highly statistically significant ($P<0.001$). It was also noted that Staphylococcus was the most common isolated organism from the cannula tip (64.3%). Finally the count of collected organism ($>100\ x10^3$) was higher before implementing the care bundle (50%) compared to post implementation.

V. Discussion

Peripheral intravenous cannula is a routinely performed procedure and has an associated risk of infection due to the potential for direct microbial passage to the bloodstream. Intravenous cannula may be contaminated by flora present on the patient skin, or by the passage of other organisms via the cannula hub or injection port. (Department of health, 2011).

The current study showed that more than half of the study sample had diploma degree, and only 20% of them had previous training courses on peripheral cannula care bundle. A study also revealed that an intravenous treatment team of registered nurses taught how to insert intravenous cannulas and evaluating cannula places significantly decreased both local and systemic complications of intravenous cannulas (Stuart RL, Grayson ML, Johnson PD, 2013).

Regarding site of cannula insertion, it can be seen that the most common site for inserting the peripheral cannula is the median cubital vein in the forearm. This comes in agree with (Easterlow, D., et al, 2010) who reported that arms were considered the better place for cannula insertion. Another study noted that inserting the cannula in the legs has a great risk for cannula-related sepsis (Marsh N, Webster, J., Mihala G, Rickard CM, 2015).

As regards to nurses compliance with peripheral vascular cannula care bundle elements: it was noted that skin preparation by using 2% chlorhexidine gluconate in 70% isopropyl alcohol was done by only 6.2% pre-education compared to 100% post-education which was statistically significant ($P<0.001$). This come in accordance with (Rowley S, 2001 and Darouiche et al, 2010) who reported that, the use of 2% chlorhexidine is more effective than the use of ten percent povidone-iodine in the alteration of development cannula-related sepsis. Also (World Health Organization, 2009) showed that, Alcoholic chlorhexidine is a suitable substance to be used as disinfection prior to a device is inserted to minimize the hazard of contamination.

As regards to dressing as an insertion action of peripheral cannula; using a sterilized visible dressing to let inspection of placing site was done by 73.3% of nurse pre-education compared to 100% post- education which was statistically significant ($P<0.001$). This comes in agree with (Easterlow, D., et al, 2010, and Rowley S, 2001) who reported that following insertion of an intravenous cannula, the cannula place had to be protected by sterile gauze or a sterile transparent semi-permeable dressing. Another study agreed with us is (Lavery, I., 2007) who noted that model characteristics for an intravenous exit-site bandage involve sterility, safe fixation, avoidance of humidity buildup, capability to visualize the exit site, effortlessness of utilize and cost-effectiveness. In addition, (Easterlow, D., et

al, 2010) showed that, following placement of intravenous cannulas, the cannula placement had to be evaluated daily, either when changing dressing or by palpating it without removing dressing.

The current study revealed that, 40% of the study sample perform documentation as an insertion action compared to 100% in first observation post-education, 76.7%, 76.7%, 70% and 76.7% in 2nd, 3rd, 4th and 5th observations respectively. This is evidenced by researches representing that wards with detailed intravenous documents have associated with less complications (**Carlet, J., et al; 2009**). Some nurse found the documenting of cannula has been forgotten due to the busy climate of the critical care unit.

As regards to cannula replacement action, the study showed significantly improved post-education of peripheral intravenous cannula care bundle ($P < 0.001$). This come in contrast with Cochrane review who noticed that there was no benefit from changing intravenous cannulas every 72–96 hours in comparison with clinically indicated replacement (**Carlet, J., et al; 2009; Zingg W, 2009 and Joanna B, 2008**) also (**Easterlow, D., et al, 2010**) reported that changing peripheral intravenous cannulas at 3 to 4 days is more relaxed and less expensive than routine changing from 2-3 days without significant increase in the risk of infection.

It was noted that in our study, the overall nurse compliance with peripheral intravenous cannula care bundle improved significantly in all elements of insertion and ongoing care actions, this was in accordance with (**Sirapayo A, 2014**), who stated that the overall compliance was 58.6% which improved significantly to 77.3% after intervention. Also, a study of 3165 patients showed that recruiting of well-trained intravenous teams could essentially alter peripheral intravenous cannula complications (**Brunelle D, 2003**).

Regarding complications pre and post-implementation of the cannula care bundle: it was noted that inflammation at cannula site was significantly decreased post care bundle education ($P < 0.001$). This comes in agree with (**Health Protection Scotland Targeted Literature Review, 2012**) who noted that Prevention of cannula infections requires adherence to strict sterile technique and subsequent meticulous insertion site care.

The present study also revealed that, the presence of microorganisms was 46.7 pre-education compared to 3.3 post education which was highly statistically significant ($P < 0.001$). (**Whitman, 2006**) reported that ensuing infection is the most common complication associated with intravascular devices and subsequent bacteremia (occurring in ~ 3–5% of central venous cannulas and ~ 0.5% of peripheral cannulas) which can be a highly morbid and oftentimes lethal consequence. An Australian study showed a bacteremia rate of 1 per 3,000 cannula, and more recently an infection rate of 0.2 per 1,000 intravenous cannula days has been demonstrated (**McLaws M L, Taylor PC, 2003**).

The study also noted that *Staphylococcus aureus* was the most common isolated organism from the cannula tip (64.3%). This come in accordance with (**King, MD., et al, 2006**) who noted that, most PIV-related bacteremia are due to *Staphylococcus aureus* and are associated with the most severe complications, with a mortality rate that can approach 20%–30%. Another study revealed that the most frequently isolated microorganisms from all types of intravenous cannula are coagulase-negative staphylococci (35%), with *Staphylococcus aureus* was the second most common (25%) (**Drug Therapy Bulletin, 2001, McCallum, 2012**).

Conclusion and recommendations

The initial need for cannula placement, adherence to meticulous sterile surgical technique during insertion, and subsequent fastidious cannula maintenance remain the mainstays of preventing these potentially disastrous infections. Adoption of evidence-based peripheral intravenous cannula care bundle is the best approach to prevent complications in the future.

Recommendations

- Efforts must be directed to enhance expertise in IV cannula insertion and maintenance, rather than focusing on the replacement schedule.
- The organization must rely on well-trained intravenous teams, which considered an effective way to decrease peripheral intravenous cannula-related complications.
- Site monitoring after removal of peripheral intravenous cannula should be a priority in preventive efforts.
- More prospective studies are needed, both to assess the true incidence and burden of peripheral intravenous cannula -related *Staphylococcus aureus* bacteremia and to evaluate effective novel

prevention strategies, such as checklists for PIV insertion, monitoring of old peripheral intravenous cannula sites, or use of antimicrobial-coated peripheral cannulas.

- Continuous presence of any device must be reviewed and documented daily in order to decrease the hazard of complications.

References

- [1]. **Boyd S** et al Peripheral intravenous catheters: the road to quality improvement and safer patient care. *Journal of Hospital Infection*;2011. 77: 37-41.
- [2]. **Brunelle, D.** Impact of a dedicated infusion therapy team on the reduction of catheter-related nosocomial infections. *J InfusNurs.* 2003 Nov-Dec;26(6):362-6.
- [3]. **Carlet J, Astagneau P, Brun-Buisson C, Coignard B, Salomon V, Tran B, et al.** French national program for prevention of healthcare-associated infections and antimicrobial resistance, 1992–2008: positive trends, but perseverance needed. *Infect Control HospEpidemiol* 2009;30:737–45. pmid:19566444
- [4]. **Darouiche RO, Wall MJ Jr, Itani KM, et al.** Chlorhexidine-alcohol versus povidone-iodine for surgical-site antisepsis. *N Engl J Med.* 2010;362:18-26.
- [5]. **Department of Health High Impact Intervention No 2: Peripheral Intravenous Cannula Care Bundle.**2011, tinyurl.com/DH-HIA2-cannula
- [6]. **Department of Health.** The Health and Social Care Act 2008: code of practice for the NHS on the prevention and control of healthcare associated infections and related guidance. Department of Health, London; 2009.
- [7]. **Easterlow D** et al Implementing and standardising the use of peripheral vascular access devices.*Journal of Clinical Nursing*;2010. 19: 721-727.
- [8]. **Health Protection Scotland Targeted Literature Review: What are the Key Infection Prevention and Control Recommendations to Inform a Peripheral Vascular Catheter (PVC) Maintenance Care Quality Improvement Tool?**2012. tinyurl.com/HPS-PVC-rev
- [9]. **Joanna Briggs Institute** Management of peripheral intravascular devices. *Best Practice*;2008.12: 5, 1-4.
- [10]. **King MD, Humphrey BJ, Wang YF, Kourbatova EV, Ray SM, Blumberg HM** Emergence of community-acquired methicillin-resistant *Staphylococcus aureus* USA 300 clone as the predominant cause of skin and soft-tissue infections. *Ann Intern Med* 2006;144:309–17
- [11]. **Lavery I** Peripheral intravenous cannulation: safe insertion and removal. *Nursing Standard*;2007. 22: 1, 44-48
- [12]. **Managing** bloodstream infection associated with intravascular catheters. *Drug Therapy Bulletin* 2001, 39:75–80
- [13]. **Marsh N, Webster J, Mihala G, Rickard CM.** Devices and dressings to secure peripheral venous catheters to prevent complications. *Cochrane Database Syst Rev* 2015;6:CD011070.
- [14]. **McCallum, L., & Higgins, D.** Care of peripheral venous cannula sites. *Nursing times*, 2012. 108(34-35), 12-14.
- [15]. **McCann, J., Holmes, H., Robinson, J., & Putterman, A.** *Nursing procedures.* 4th ed. Philadelphia: A WoltersKluwer Co. 2004; PP. 270-370. Chapter 6.
- [16]. **McLaws M L, Taylor PC.** The Hospital Infection Standardised Surveillance (HISS) programme: analysis of a two-year pilot. *Journal of Hospital Infection* 2003, 53:259–267
- [17]. **Recchia, M., Chen, E., & Magaluri, S.** Central venous occlusion is not an obstacle to device upgrade with the assistance of laser extraction. *Pacing Clin Electrophysiol*; 2005. 28 (7),661-6.
- [18]. **Rowley S** Theory to practice: aseptic non-touch technique. *Nursing Times*; 2001. 97: 7, 7-8.
- [19]. **Sriupayo, A., Inta, N., Boonkongrat, S., Kaphan, K., Uttama, J., Budsabongphiwan, S., et al.** Effectiveness of peripheral vascular catheter care bundle in the pediatric nursing service. *Chiang Mai Med J*; 2014. 53(2), 63-70.
- [20]. **Stuart RL, Grayson ML, Johnson PD.** Prevention of peripheral intravenous catheter-related bloodstream infections: the need for routine replacement. *Med J Aust* 2013; 199:751.
- [21]. **Whitman E D.** Complications associated with the use of central venous access devices. *Curr Prob Surg.* (2006; 33:311–378.
- [22]. **World Health Organization WHO Guidelines on Hand Hygiene in Health Care: First Global Patient Safety Challenge. Clean Care is Safer Care.** Geneva: WHO.2009, tinyurl.com/WHOhand-hygiene
- [23]. **Zingg W, Pittet D.** Peripheral venous catheters: an under-evaluated problem. *Int J Antimicrob Agents* 2009;34:S38–42. pmid:19931816

Walaa Nasreldin Othman Effect of Execution of the Peripheral Intravenous Cannula Care Bundle on Reducing the Incidence of Infection.” *IOSR Journal of Nursing and Health Science (IOSR-JNHS)* , vol. 6, no.6 , 2017, pp. 67-74