

Effectiveness of peripheral vascular catheter care bundle in the Pediatric Nursing Service, Chiang Mai University Hospital, Thailand

Anchan Sriupayo, B.N.S.,¹ Nonglak Inta, M.N.S.,¹ Supaporn Boonkongrat, M.N.S.,¹ Kraiwan Kaphan, M.N.S.,¹ Jongkonnee Uttama, M.N.S.,¹ Saengdao Budsabongphiwan, B.N.S.,¹ Chaweewan Prasertwittayakij, B.N.S.,¹ and Peninnah Oberdorfer, M.D., Ph.D.,²

¹Division of Nursing, Maharaj Nakorn Chiang Mai Hospital, ²Department of Pediatrics, Faculty of Medicine, Chiang Mai University

Objective The main purpose of this study was to compare the outcomes and nurse compliance before and after implementation of peripheral vascular catheter (PVC) care bundle.

Methods This study was conducted at Maharaj Nakorn Chiang Mai Hospital. The samples included children and infants admitted to pediatric wards, with pediatric nurses. Four thousand seven hundred and eight peripheral catheter insertion sites were evaluated, and 140 registered nurses were observed for compliance to the peripheral vascular catheter care bundle. Data were collected from October, 2011 to August, 2012. The research tools consisted of the following: 1) The Peripheral Vascular Care Bundle by the Health Protection of Scotland, 2) The Complication Assessment Form, and 3) The Nursing Action Observation Form. The peripheral vascular care bundle was implemented by providing training and knowledge for pediatric nurses. The establishment of strategies to promote the implementation of care bundle, support of equipment, and provision of feedback, were included. Data were collected before and after implementing the care bundle. The Chi-square statistical test was used to compare data.

Results The results showed that after implementing care bundle; there were no infections at the catheter insertion sites and no bloodstream infections. The infiltration rate decreased significantly from 5.6 to 0.8 episodes per 100 PVC insertions ($p < 0.001$), and the phlebitis rate decreased significantly from 0.6 to 0.2 episodes per 100 PVC ($p = 0.02$). Overall nurse compliance with PVC bundle was 58.6%, which improved significantly to 77.3% after intervention ($p < 0.001$).

Conclusions The findings indicated that implementation of the PVC bundle reduced complications in children and infants who received a peripheral vascular catheter. The PVC bundle should be promoted in nursing services, for sustainable and best nursing practices. **Chiang Mai Medical Journal 2014;53(2):63-73.**

Keywords: peripheral vascular catheter, care bundle, pediatric, nursing compliance

Introduction

The insertion of peripheral venous catheters (PVC) is the most common invasive procedure among patients admitted to hospital, with about half of them receiving intravenous therapy during their stay^[1]. The procedure aims to replace fluids, blood or blood components, and administer intravenous drugs to patients. The use of PVCs is associated with the risk of complications such as phlebitis (inflammation of the vein), infiltration (leakage of fluid out of the vein), local skin infection, and catheter-related bloodstream infection (CRBSI)^[1-4]. Children are at greater risk of complications, due to the smaller size of their veins and reduced blood flow around the cannula tip^[5].

The most frequent PVC complication is phlebitis, which occurs in approximately 2-80% of patients, based on clinical findings such as redness, swelling, tenderness, pain, warmth, palpable cord or purulent discharge^[6,7]. The risk for phlebitis exceeds 50% by day four post catheterization^[8]. This complication has occurred in patients with extended hospital stays of two to five days^[9]. Infiltration is also one of the most frequent local complications. The severity of this complication depends on the infusion flow, elasticity of subcutaneous tissue, and time until its identification. Infiltration interrupts intravenous therapy in 21.2% of pediatric patients^[4]. The literature states that although the incidence of local or bloodstream infections associated with PVCs is usually low, they produce considerable morbidity, due to migration of skin organisms from the insertion site into the cutaneous catheter tract and along the external surface of the catheter. This could lead to systemic blood infection, which in turn may cause life-threatening complications^[10]. CRBSI rates have occurred in several studies at 1.2-5.7 cases per 1,000 catheter-days in non-intensive care units, which is similar to those in intensive care units at 1.5-5.2 cases per 1,000 catheter-days^[11-13]. In consequent complications, patients suffer from pain and may require longer

treatment in hospital, which increases the cost of medical care.

Most previous studies reported the risk factors of PVC complications, which comprised patient characteristics, therapy administered, practice of health professionals, and materials used^[2,14-17]. Nurses, in particular, have important responsibilities in intravenous catheter application. Poor nurse compliance with care regarding PVC is related to serious events of infectious complications^[14,15,18]. Nursing practice by empirical evidence contributes to the quality of care and produces better results for patients^[19]. Nursing care must be given correctly and consistently in order to be effective. 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^[20]. According to the literature, the care bundle decreases complications and length and cost of hospital stay^[21-24]. The bundle was developed for PVC care by the Health Protection of Scotland^[25], and following PVC care bundle standards provides good practice and decreased complications^[16].

Maharaj Nakorn Chiang Mai Hospital is a 1,500-bed university hospital located in the north of Thailand. It serves about 50,000 patients per year. The pediatric department provides care for nearly 7,000 patients annually, with approximately 80% of them receiving PVCs, usually from pediatric nurses. Prevalence surveys on phlebitis were performed in 2010, and they found that 4% of patients with a peripheral catheter had phlebitis of more than Grade 2^[26]. Other complications related to PVCs have no documentation. In order to improve maintenance and care, intervention was implemented through the care bundle of PVCs in a pediatric ward setting. Therefore, this study proposed a comparison of outcomes before and after implementing the PVC care bundle, including infiltration, phlebitis, inserted catheter site infection, and blood stream infection, as well as compare nurse compliance before and after initiating PVC care bundle.

Method

Design and setting

This quasi-experimental prospective study was approved by the Institutional Review Board of Chiang Mai University Hospital, Thailand. All subjects, including parents of patients and nurses, received an explanation of the research purposes, procedures, and benefits. Written informed consent was obtained from parents of the voluntary participants. The study was conducted from October, 2011 to August, 2012 in the Pediatric Nursing Service of Maharaj Nakorn Chiang Mai Hospital, Thailand, which consists of 11 wards, including two neonatal and two pediatric intensive care units.

Subjects

Eligible subjects were newborns, infants, and pediatric patients, who received PVCs with permission from the parents. The sample size was calculated from 4% phlebitis in Chiang Mai University Hospital in 2010 (control group)^[26], and 2.5% phlebitis after implementing the care bundle in Ninewells Hospital, Scotland, in 2008 (intervention group)^[16]. Estimated sample size was used for two-sample comparison of proportion by STATA software, with alpha 0.05 and power 0.80. This implied a sample size of 2,325 subjects in each group. This study collected the data of 2,252 and 2,456 PVC insertion sites in the control and intervention group, respectively. One hundred and forty pediatric nurses were willing to participate in this study. The events were calculated to observe implementation of the care bundle, based on the research study of Prompriang *et al*^[27], which showed that nurse compliance with PVC care, using evidence based practices, improved from 67.4% at baseline to 99.1% after intervention. Observations of alpha 0.05 and power 0.80 were calculated at least 22 times per nurse before and after intervention. This study observed 2,444 and 2,347 nursing practices before and after intervention, respectively, for nurse compliance.

Instruments

The research instruments consisted of the following:

1. Peripheral Vascular Care Bundle adapted from the Health Protection of Scotland PVC bundle^[25] comprised the following: 1.1) PVC in situ – is it still required? 1.2) PVC removal where there is extravasation or inflammation. 1.3) PVC checks that dressings are intact. 1.4) Hand hygiene performed before and after all PVC procedures. The rest of the bundle included “removing the PVC if it is in situ longer than 72-96 hours”, but that was deleted due to insufficient evidence of the benefit. Recently, updated CDC guidelines state that replacement of PVCs in adults, as indicated clinically, is an unresolved issue and cites insufficient current evidence to recommend it, specifically regarding CRBSI^[28]. Ascoli GB *et al*^[29] supported the recommendation to remove PVCs based on clinical indication, rather than a standard time interval.

2. The Complication Assessment Sheet was developed, based on a previous study at Chiang Mai University^[30]. It included the following general patient characteristics: sex, age, position of catheter sites, type of hypertonic solution, treatment affecting the immune system, medications administered via PVC, blood transfusions given via PVC, and retention days of PVC. The complications comprised the incidence of infiltration investigated using the infiltration scale (Figure 1)^[17]. Furthermore, the incidence of phlebitis utilized the phlebitis scale (Figure 2)^[17]. In addition, the incidence of skin infection from and bloodstream infections associated with a peripheral intravenous catheter also were evaluated.

3. The Nursing Action Observation Sheet collected general nurse characteristics and recorded the nursing practices observed in bundle care usage (nurse compliance). The compliance of four individual bundle elements was measured, as well as the overall compliance with PVC care bundle. Correct or incorrect practices from bundle elements for each observation of nursing practice were recorded.

To verify accuracy of the contents (content validity), validity of the instruments was checked for infection control by three specialists, including an infection control physician, infection control nurse (ICN), and advanced practice nurse (APN). The content validity index (CVI) was calculated with a value equal to one. To determine reliability of the tools, a complication assessment sheet was used to evaluate ten patients. After recording complications of the peripheral intravenous catheter, inter-rater reliability was calculated to 0.92. Then, the nursing action observation sheet was used to observe ten nurses. The inter-rater reliability of this instrument was 0.95.

Grade	Clinical criteria
0	<ul style="list-style-type: none"> No symptoms
1	<ul style="list-style-type: none"> Skin blanched Oedema <1 inch (2.5cm) in any direction Cool to touch With or without pain
2	<ul style="list-style-type: none"> Skin blanched Oedema 1–6 inches (2.5cm–15cm) in any direction Cool to touch With or without pain
3	<ul style="list-style-type: none"> Skin blanched, translucent Gross oedema >6 inches (15cm) in any direction Cool to touch Mild to moderate pain Possible numbness
4	<ul style="list-style-type: none"> Skin blanched, translucent Skin tight, leaking Skin discoloured, bruised, swollen Gross oedema >6 inches (15cm) in any direction Deep pitting tissue oedema Circulatory impairment Moderate to severe pain Infiltration of any amount of blood product, irritant, or vesicant

Figure 1. Infiltration scale (INS, 2006 cited in Royal College of Nursing, 2010)

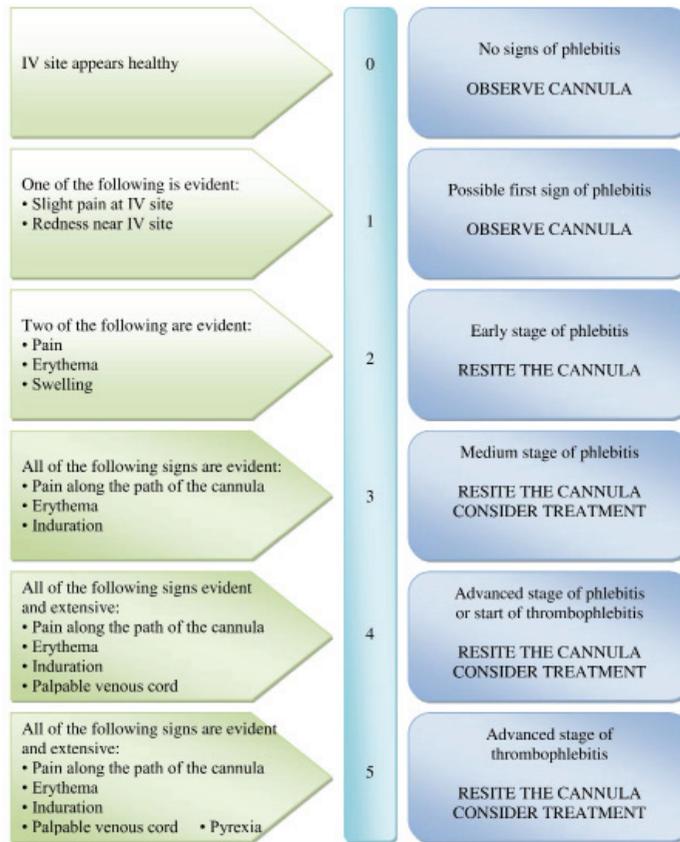


Figure 2. Phlebitis scale (Jackson, 1998 cited in Royal College of Nursing, 2010)

Procedures and data collection

The baseline phase for this study was carried out from October, 2011 to January, 2012 (four months). The demographic data of peripheral catheter sites among neonatal and pediatric patients were recorded by research assistants in their ward. Complications such as infiltration, phlebitis, and skin infection from and bloodstream infections associated with the peripheral intravenous catheter in each site also were recorded every evening. Nurse compliance with PVC care bundles was collected from observations by research assistants. Random observation of nursing practice was conducted during the morning shift, five days per week. Each nurse would be observed randomly by research assistants for at least 22 events of specific care bundle elements. To evaluate a care bundle element, nursing practices of PVC care were observed, including the needle for fluid, change of material that covered the distal catheter, change of the intravenous fluid set, change of the needle position, change of bags or bottles of fluid, preparation of intravenous drugs, and hand hygiene before and after PVC insertion.

The intervention phase was carried out from February to April, 2012 (three months). The PVC care bundle was applied. Various strategies were used to promote compliance

with this bundle, included training, meetings, or providing PVC care bundle knowledge. Booklets on the bundle were distributed to nurses, who attended training for thoroughness, accuracy, and consistency of care bundle elements prior to implementation. Meetings were organized weekly for feedback from nurses who implemented the bundle. Other strategies included encouraging every participant, organizing a slogan contest, attracting attention by publicity posters, and facilitating materials. Regular individual feedback was allowed by the researchers. Supervision and reminders were provided through educational demonstration, return demonstration, and assessment practices.

The post intervention phase was carried out from May to August, 2012 (four months). The data were collected by following the same guidelines as those in the baseline phase. Patients who received PVCs during this time were evaluated together with observation of nursing practices. Randomized observation of compliance was conducted in the same way as that in the baseline period.

Statistical analysis

The collected data were analyzed using SPSS for Windows Version 16 (SPSS, Inc., Chicago, IL). The general

characteristics of patients and nurses were analyzed in frequency and percentage by descriptive statistics. The homogeneity of general characteristics in the control and intervention group was analyzed by the chi-square test.

Complications such as infiltration, phlebitis, skin infection, and bloodstream infections associated with the peripheral intravenous catheter were presented by number of times per 100 PVC insertions, and unadjusted incidence relative risk ratios (IRRs). Comparisons of the complications were analyzed using the chi-square test.

Compliance with the PVC care bundle was calculated by dividing the number of correct practices in each element and overall elements by the number of observation records and multiplying by 100. Comparison of compliance was analyzed using the McNemar chi-square test.

Results

This study collected the data of 2,252 and 2,456 events in the control and intervention group,

respectively. The demographic data of peripheral catheter events are shown in Table 1. There were no statistically significant differences in ages of the pediatric patients or medications via PVC. Nearly half of the PVC sites among both groups were found in patients older than one month to six years old. The majority of them received medication via PVC, while the catheter position sites and hypertonic solution given were similar at a p value of 0.01. Almost all PVC sites were maintained for one to four days, but the difference was statistically significant. Similarly, sex, treatment affecting the immune system, and blood transfusions via PVC presented significant differences among both groups.

The characteristics of the 140 pediatric nurses, who participated in this study, are shown in

Table 1. Demographic data of neonatal and pediatric patients

	Control group (n=2,252)	Intervention group (n=2,456)	χ^2	<i>p</i>
Sex			8.30	0.004
Male	1,298 (57.6)	1,313 (53.5)		
Female	954 (42.4)	1,143 (46.5)		
Age			4.42	0.22
0-1 month	720 (32)	752 (30.6)		
> 1 month - 6 years	1,002 (44.5)	1,070 (43.6)		
> 6 years - 15 years	449 (19.9)	523 (21.3)		
> 15 years	81 (3.6)	111 (4.5)		
Position of catheter sites			4.00	0.046
Limbs (arms, legs, hands, and feet)	1,752 (77.8)	1,969 (80.2)		
Head and others	500 (22.2)	487 (19.8)		
Hypertonic solution			6.39	0.01
Yes	1,370 (60.8)	1,405 (57.2)		
No	882 (39.2)	1,051 (42.8)		
Treatment affecting the immune system			36.68	<0.001
Yes	578 (25.7)	829 (33.8)		
No	1,674 (74.3)	1,627 (66.2)		
Medications via PVC			0.032	0.8636
Yes	1,727 (76.7)	1,878 (76.5)		
No	525 (23.3)	578 (23.5)		
Blood transfusions via PVC			18.43	<0.001
Yes	157 (7.0)	258 (10.5)		
No	2,095 (93.0)	2,198 (89.5)		
Retention days of PVC			53.01	<0.001
1-4 days	2,109 (93.7)	2,404 (97.9)		
> 4 days	143 (6.3)	52 (2.1)		

Table 2. Characteristics of Pediatric Nurses (n=140)

	n (%)
Education	
Bachelor's degree	125 (89.3)
Master's degree	15 (10.7)
Experience in hospital (years)	
0-1	13 (9.3)
>1-3	21 (15.0)
>3-5	17 (12.1)
>5-10	29 (20.7)
>10	60 (42.9)
Previous information on prevention of complications or infection from PVC	
Yes	96 (68.6)
No	44 (31.4)
Previous training or conference attendance on the prevention of complications or infection from PVC in the first part of the year.	
Yes	71 (50.7)
No	69 (49.3)
Previous training or conference attendance on the PVC care bundle in the first part of the year.	
Yes	78 (55.7)
No	62 (44.3)

Table 2. About 89% of them graduated with a bachelor's degree and 42.9% had hospital experience of more than ten years. Only half of the nurses participating had attended training or conferences on the prevention of complications or infection from PVCs, or had experienced using the PVC bundle in the first part of the year.

After implementing the PVC care bundle, the outcome measurement showed that the infiltration rate decreased significantly from 5.6 to 0.8 episodes per 100 PVC insertions ($p < 0.001$). The phlebitis rate also decreased significantly from 0.6 to 0.2 episodes per 100 PVC insertions during the intervention phase ($p = 0.02$), as shown in Table 3. Nevertheless, no infections were found at the inserted catheter sites or bloodstream infection during the study period.

The nurse compliance to individual elements of the PVC care bundle in both groups is presented in Table 4. At baseline, the overall compliance was 58.6%, which improved significantly to 77.3% after intervention ($p < 0.001$). All four bundle elements increased significantly. Furthermore, checking intact PVC dressings and performing hand hygiene before and after all PVC procedures appeared to increase by more than ten percent after intervention.

Table 3. Outcome measures.

Complication	Control group n (per 100 PVC insertions)	Intervention group n (per 100 PVC insertions)	χ^2	p	RR (95% CI)
Infiltration	125 (5.6)	20 (0.8)	88.28	<0.001	0.14 (0.29-0.23)
Phlebitis	14 (0.6)	5 (0.2)	5.11	0.02	0.33 (0.12-0.91)

Table 4. Nurse Compliance with peripheral vascular catheter care bundle elements

Bundle Elements	History (2,444 observed) n (%)	Post-intervention (2,347 observed) n (%)	χ^2	p
Checking PVCs in situ is still required	2,249 (92.0)	2,341 (99.7)	1.77	<0.001
Removing PVCs from extravasation or inflammation	2,311 (94.6)	2,293 (97.7)	31.49	<0.001
Checking that PVC dressings are intact	2,027 (82.9)	2,211 (94.2)	1.49	<0.001
Performing hand hygiene before and after all PVC procedures	1,706 (69.8)	1,898 (80.9)	78.66	<0.001
Overall compliance (all 4 bundle elements completed)	1,431 (58.6)	1,815 (77.3)	1.93	<0.001

Discussion

The Institute for Healthcare Improvement (IHI) introduced care bundles in order to help healthcare providers improve delivery of the evidence-based healthcare process^[22, 31], which is defined as a collection of processes needed to care for patients effectively and safely. When implemented, several interventions are ‘bundled’ together and should function as a package to improve patient care outcomes significantly^[18,20,32]. The PVC care bundle implemented in this study included: 1) checking the position of PVCs, 2) removing the PVC from extravasation or inflammation, 3) checking that PVC dressings are intact, and 4) performing hand hygiene before and after all PVC procedures. Following PVC care bundle standards provides good practice and can decrease complications^[25]. This study showed significantly decreased local complications of phlebitis and infiltration in children and infants receiving PVC after implementing the PVC care bundle, while no infection was identified.

For an efficient PVC care bundle, it was found that checking intact dressing and immediately removing the PVC from extravasation or inflammation prevented phlebitis and infections in patients receiving PVC^[33]. Another recommended practice for preventing intravascular catheter-related infection was daily evaluation of the catheter insertion site by palpation through the dressing, in order to discern tenderness through inspection of a transparent dressing, as used in this study. Although either sterile gauze or transparent, semi-permeable dressings are recommended to cover the catheter site, the transparent dressing was a practical consideration for enabling easy visualization of the PVC site^[10]. If the patient had local tenderness or other signs of possible CRBSI, the dressing was removed and the site observed visually^[21]. Simultaneously, dressings should not be removed if the patient has no clinical signs of infection. In the literature, a Cochrane review concluded insufficient evidence of benefit from routinely removing catheters every 72 to 96 hours, and suggested that

catheters, including PVCs, be changed on clinical indication^[34]. On the other hand, the longer a catheter stays in place, the greater the risk of complications^[28] and PVCs inserted unnecessarily should be removed. Finally, a very important recommendation is hand hygiene performance before and after procedures, in order to prevent healthcare-associated infections. Many recent studies have indicated that hand hygiene can decrease the prevalence of nosocomial infection rates from antibiotic-resistant organisms in hospitals^[35,36]. The results of this study implied better patient outcomes by implementing a group of effective interventions^[37].

Many studies have reported that after implementing the PVC care bundle, complications were reduced. After implementing the PVC care bundle in Scotland, the skin infection rate reduced from 11.0% to 2.5%^[8]. A study by Fakih *et al*^[18] found a significant reduction in PVC-associated bloodstream infections; from 2.2 cases to 0.44 cases per 10,000 patient days, while implementing a process to improve PVC care in ten non-intensive care units. Similarly, Bonnici^[18] suggested that significant reduction in the incidence of inflammation associated with peripheral intravenous catheters may be achieved by performing daily cannula assessments, and replacing catheters after 72 hours. In Thailand, Prompriang *et al*^[27] found that promoting the use of evidence based practice for preventing infection decreased the incidence of peripheral intravenous infection in a provincial hospital. In addition, care bundle decreased complications, and the length and cost of hospital stay, according to the literature^[21-24].

The results of this study found that nurse compliance with the PVC care bundle increased significantly in all elements. The literature indicated factors that act as care bundle barriers, including lack of knowledge, unavailable resources, high costs, nursing convenience, fear of adverse events or patient discomfort, and disagreement on the strength of supporting evidence in conjunction with external barriers^[37]. Meanwhile, educational efforts based on a single strategy are

frequently unsuccessful^[39]. Accordingly, a multi-modal program is more likely to be successful in effecting compliance^[22,38]. This study established many strategies to promote the implementation of care bundle such as training, meetings, distributing a PVC care bundle booklet, organizing a slogan contest, attracting attention by posters, facilitating materials, and providing feedback. An important aspect of this study was providing feedback on performance to nurses in measurable real time data. It was found that nurse compliance with care bundles improved when provided with individual feedback. Several studies suggested that educational interventions have more prolonged effect if combined with feedback^[14,22,38].

This study initiated the PVC care bundle for intervention in Thailand, and good outcomes for patients regarding infiltration and phlebitis were clearly achieved. In the meantime, several strategies have been used to implement the care bundle. Improving pediatric nurse compliance with the PVC care bundle produced lower complications than before. Nurses are now more concerned with the importance of using the bundle. This should help in improving the quality of care for patients with PVC in situ^[22].

Simultaneously, this study might be biased in the data collected on nurse compliance because the observation method used might have the Hawthorne effect. Otherwise, the variables were uncontrolled before and after implementation insofar that the actual situation of patients was studied in the hospital. Perchance, there were distinctions of certain variables such as gender, receiving hypertonic solutions, treatment affecting the immune system, blood transfusion via PVCs and retention days of PVCs.

The findings of this study indicated that implementing the PVC care bundle reduced complications in children and infants receiving PVC. The nursing department should promote the care bundle as sustainable nursing practice and encourage nurses to use and follow it strictly.

The authors express appreciation to the participants and their parents. The researchers gratefully acknowledge the pediatric nurses and

administrators of the Pediatric Nursing Department, Maharaj Nakorn Chiang Mai Hospital for their cooperation.

This study was funded by the Faculty of Medicine, Chiang Mai University, Thailand, and the researchers have no conflicts of interest.

References

1. **Pujol M, Hornero A, Saballs M, et al.** Clinical epidemiology and outcomes of peripheral venous catheter-related bloodstream infections at a university-affiliated hospital. *J Hosp Infect* 2007;67(1):22-9.
2. **Oliveira AS, Pedro P, Pedro V.** Incidence of phlebitis in patients with peripheral intravenous catheters: The influence of some risk factors. *The Australian Journal of Advanced Nursing* 2012;30(2):32-9
3. **González López JL, Arribi Vilela A, Fernández Del Palacio E, Olivares Corral J, Benedicto Martí C, Herrera Portal P.** Indwell times, complications and costs of open vs closed safety peripheral intravenous catheters: a randomized study. *J Hosp Infect.* 2014; 86(2):117-26. doi: 10.1016/j.jhin.2013.10.008. [Epub 2013 Dec]
4. **de Lima Jacinto AK, Avelar AF, Pedreira ML.** Predisposing factors for infiltration in children submitted to peripheral venous catheterization. *J Infus Nurs* 2011;34(6):391-8. doi:10.1097/NAN.0b013e3182306491.
5. **Bravery K.** Paediatric intravenous therapy in practice. In: Dougherty L, Lamb J, editors. *Intravenous Therapy in Nursing Practice.* 2nd ed. Malden, MA: Blackwell; 2008:408-60.
6. **Zingg W, Pittet D.** Peripheral venous catheters: an under-evaluated problem. *Int J Antimicrob Agents* 2009;34(Suppl4):S38-42. doi: 10.1016/S0924-8579(09)70565-5.
7. **Tagalakis V, Kahn SR, Libman M, Blostein M.** The epidemiology of peripheral vein infusion thrombophlebitis: a critical review. *Am J Med* 2002;113(2):146-51.
8. **Maki DG, Ringer M.** Risk factors for infusion-related phlebitis with small peripheral venous catheters. A randomized controlled trial. *Ann Intern Med* 1991; 114(10):845-54. doi 10.1326/003-4819-114-10-845.
9. **Campbell L.** IV-related phlebitis, complications and length of hospital stay: 2. *Br J Nur* 1998;7(22):1364-373.
10. **O'Grady NP, Alexander M, Burns LA, et al.** Guidelines for the prevention of intravascular catheter-related infections. *Clin Infect Dis* 2011;52(9):e162-93, doi: 10.1093/cid/cir257. Epub 2011 Apr1.
11. **Kallen AJ, Patel PR, O'Grady NP.** Preventing catheter-related bloodstream infections outside the intensive care unit: expanding prevention to new settings. *Clin Infect Dis* 2010;51(3):335-41. doi: 10.1086/653942

12. **Marschall J, Leone C, Jones M, Nihill D, Fraser VJ, Warren DK.** Catheter-associated bloodstream infections in general medical patients outside the intensive care unit: a surveillance study. *Infect Control Hosp Epidemiol* 2007;28(8):905-9.
13. **Freixas N, Bella F, Limón E, Pujol M, Almirante B, Gudiol F.** Impact of a multimodal intervention to reduce bloodstream infections related to vascular catheters in non-ICU wards: a multicentre study. *Clin Microbiol Infect* 2013;19(9):838-44. doi: 10.1111/1469-0691.12049. Epub 2012 Nov 6.
14. **Frigerio S, Di Giulio P, Gregori D, et al.** Managing peripheral venous catheters: an investigation on the efficacy of a strategy for the implementation of evidence-based guidelines. *J Eval Clin Pract* 2012;18(2):414-9. doi 10.1111/j.1365-2753.2010.01590.x. Epub 2010 Nov 30.
15. **Lee WL, Chen HL, Tsai TY, et al.** Risk factors for peripheral intravenous catheter infection in hospitalized patients: a prospective study of 3165 patients. *Am J Infect Control* 2009;37:683-6.
16. **Watson C, Crofts S, Soutar B.** Vascular Care Bundles: Implementation and Outcomes. Dundee: Ninewells Hospital [Internet]. 2008 [cited 2011 Aug 24]. Available from: <http://ebookbrowse.net/1705-Watson-ESPI-posters-Vascular-Care-Bundles-1-1-pdf>.
17. **Royal collage of nursing.** Standards for infusion therapy: The RCN IV Therapy Forum. 3rd ed. London: the Royal College of Nursing; 2010.
18. **Fakih MG, Janes K, Rey JE, et al.** Sustained Improvements in Peripheral Venous Catheter Care in Non-Intensive Care Units :A Quasi-Experimental Controlled Study of Education and Feedback. *Infect Control Hosp Epidemiol* 2012;33(5):449-455.
19. **Rosswurm MA, Larrabee JH.** A model for change to evidence-based practice. *Image J Nurs Sch* 1999;31(4):317-22.
20. **Institute of Healthcare Improvement (IHI).** Sepsis 2011 [cited 2012 Jun 11]. Available from: <http://www.ihl.org/IHI/Topics/CriticalCare/Sepsis/>
21. **Centers for Disease Control and Prevention.** Guidelines for the Prevention of Intravascular Catheter-Related Infections [Internet]. 2011 [cited 2011 Jul 4]. Available from: <http://www.cdc.gov/hicpac/BSI/01-BSI-guidelines-2011.html>
22. **Boyd S, Aggarwal I, Davey P, Logan M, Nathwani D.** Peripheral intravenous catheters: the road to quality improvement and safer patient care. *J Hosp Infect* 2011;77(1):37-41. doi: 10.1016/j.jhin.2010.09.011 Epub 2010 Dec 3.
23. **Talento AF, Morris-Downes M, Thomas T, Walsh J, Smyth E, Humphreys H, Fitzpatrick F.** Implementing peripheral vascular catheter care bundle in a tertiary care hospital: no room for complacency? 21st European Congress of Clinical Microbiology and Infectious Diseases (ECCMID). Proceedings of the 27th International Congress of Chemotherapy (ICC); 2011 May 7-10; Milan, Italy.
24. **Aziz AM.** Improving peripheral IV cannula care: implementing high-impact interventions. *British Journal of Nursing* 2009;18(20):1242-6.
25. **Health Protection Scotland.** Peripheral Vascular Catheter Care bundle, version 2008 [Electronic version]. 2011 [cited 2012 August 2]. Available from: <http://www.docstoc.com/docs/28487213/Peripheral>.
26. **The Prevention and Infection Control Unit.** Prevalence Report. Chiang Mai: Chiang Mai University Hospital; 2010.
27. **Prompriang P, Chitreecheur J, Boonchuang P.** Effects of evidence-based practice promotion for infection prevention on knowledge and practices among nurses and incidence of peripheral intravenous infection in a community hospital. *Thai Journal of Nursing Council* 2009;24(3):31-41.
28. **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? Part of HAI Delivery Plan 2011-2012 [Internet]. 2012 [cited 2012 Aug 4]. Available from: <http://www.documents.hps.scot.nhs.uk/hai/infection-control/evidence-for-care-bundles/literature-reviews/pvc-maintenance-review.pdf>
29. **Ascoli GB, DeGuzman PB, Rowlands A.** A Correlational Study to Compare Hospitalized Adults' Peripheral Intravenous Catheter Complication Rates between those Indwelling > 96 Hours to those Indwelling 72-96 Hours. *International Journal of Nursing* 2012;1(2): 8-12.
30. **Picheansathian W.** Promoting Evidence-Based Practices among Health Care workers in the management of Peripheral Intravascular Devices. Chiang Mai: Faculty of Nursing Chiang Mai University; 2011.
31. **Marwick C, Davey P.** Care bundles: the holy grail of infectious risk management in hospital? *Curr Opin Infect Dis* 2009;22(4):364-69. doi:10.1097/QCO.0b013e32832e0736
32. **High Impact Intervention:** Peripheral Intravenous cannula care bundle. Department of Health. 2011 [cited 2012 Mar 30]. Available from: URL: <http://hcai.dh.gov.uk/whatdoido/high-impact-interventions/>
33. **Achariyakaroon N.** Effect of two different intravenous injection site cares on rate and duration of onset of phlebitis (Master thesis in adult nursing). Bangkok: Rangsit Univ.; 2008.
34. **Webster J, Osborne S, Rickard C, Hall J.** Clinically-indicated replacement versus routine replacement of peripheral venous catheters. *Cochrane Database Syst Rev* 2010;17(3):CD007798. doi: 10.1002/14651858

35. **Grayson ML, Russo PL, Cruickshank M, et al.** Outcomes from the first 2 years of the Australian National Hand Hygiene Initiative. *Med J Aust* 2011;195(10):615-9. doi: 10.5694/mja11.10747
36. **Graves N, White K, Jimmieson N, et al.** Evaluating hand hygiene interventions and their ability to reduce healthcare associated infection: NHMRC Partnership Project ANNUAL REPORT June 2012 [Internet]. 2012 [cited 2012 Jul 4]. Available from: https://wiki.qut.edu.au/download/attachments/105043201/2012+Annual+Report_NHHIE+Project.pdf?version=1&modificationDate=1343690017000
37. **Camporota L, Brett S.** Care bundles: implementing evidence or common sense? *Crit Care* 2011;15(3):159. doi: 10.1186/cc10232. Epub 2011 May 24.
38. **Bonnici ET.** Safer patient care through better Peripheral Intravenous Catheter management. *Int J Infect Control* 2012; v8:i2. doi: 10.3396/ijic.v8i2.017.12
39. **Morse L, McDonald M.** Failure of a poster-based educational programme to improve compliance with peripheral venous catheter care in a tertiary hospital. A clinical audit. *J Hosp Infect* 2009;72(3):221-6. doi: 10.1016/j.jhin.2009.03.009. Epub 2009 May 23.

ประสิทธิผลของการพยาบาลผู้ป่วยเด็กและทารกที่ใส่สายสวนหลอดเลือดดำส่วนปลายโดยใช้ชุดการดูแล งานการพยาบาลผู้ป่วยกุมารเวชศาสตร์ โรงพยาบาลมหาราชนครเชียงใหม่

อัญชัญ ศรีอุบาย, พย.บ.,¹ นงลักษณ์ อินตา, พย.ม.,¹ ไกรวรรร กาพันธ์, พย.ม.,¹ สุภาพร บุญกองรัตน์, พย.ม.,¹
จกกลณี อุตตมะ, พย.ม.,¹ แสงดาว บุชบงไพรวลัย, พย.บ.,¹ ฉวีวรรณ ประเสริฐวิทยากิจ, พย.บ.,¹ และ
เพณณินาท์ โอเบอร์เตอร์เฟอร์, พ.บ., Ph.D.²

¹ฝ่ายการพยาบาล โรงพยาบาลมหาราชนครเชียงใหม่, ²ภาควิชากุมารเวชศาสตร์ คณะแพทยศาสตร์
มหาวิทยาลัยเชียงใหม่

วัตถุประสงค์ เพื่อเปรียบเทียบผลลัพธ์ระหว่างก่อนและหลังการใช้ชุดดูแลผู้ป่วยที่ใส่สายสวนหลอดเลือดดำ
ส่วนปลาย และเพื่อเปรียบเทียบการปฏิบัติของพยาบาลระหว่างก่อนและหลังการใช้ชุดดูแล

วิธีการวิจัย การวิจัยนี้ศึกษาในโรงพยาบาลมหาราชนครเชียงใหม่ มหาวิทยาลัยเชียงใหม่ กลุ่มตัวอย่าง
ประกอบด้วยผู้ป่วยเด็กและทารกที่เข้ารับการรักษาในหอผู้ป่วยกุมารเวชกรรม และพยาบาลที่ดูแลเด็ก โดย
เก็บข้อมูลตำแหน่งที่ใส่น้ำทางหลอดเลือดดำทั้งหมดจำนวน 4,708 ตำแหน่ง และสังเกตการปฏิบัติตามชุด
ดูแลของพยาบาล 140 ราย ตั้งแต่เดือนตุลาคม 2554 ถึงสิงหาคม 2555 เครื่องมือที่ใช้การศึกษาประกอบด้วย
1) ชุดดูแลผู้ป่วยที่ใส่สายสวนหลอดเลือดดำส่วนปลายของ The Health Protection Scotland 2) แบบ
ประเมินภาวะแทรกซ้อนจากการใส่สายสวนหลอดเลือดดำส่วนปลาย และ 3) แบบสังเกตการปฏิบัติของพยาบาล
ตามชุดดูแล โดยผู้วิจัยได้จัดอบรมและให้ความรู้เรื่องการใช้ชุดดูแลแก่พยาบาล ร่วมกับจัดทำกลยุทธ์ต่าง ๆ ใน
การนำชุดดูแลไปใช้ มีการสนับสนุนวัสดุที่จำเป็น และให้ข้อมูลย้อนกลับ ผู้วิจัยรวบรวมข้อมูลก่อนและหลังการ
ใช้ชุดดูแล แล้วนำมาวิเคราะห์เปรียบเทียบ โดยใช้สถิติโคสแควร์

ผลการศึกษา พบว่าหลังการใช้ชุดดูแล ผู้ป่วยไม่เกิดการติดเชื้อในตำแหน่งที่ใส่สายสวนหลอดเลือดดำส่วน
ปลาย และไม่เกิดการติดเชื้อในกระแสเลือด การรั่วของสารน้ำออกนอกหลอดเลือดดำลดลงจาก 5.6 เป็น 0.8 ครั้งต่อ
100 ตำแหน่งคาสายสวน ($p < 0.001$) และการอักเสบของหลอดเลือดดำส่วนปลายลดลงจาก 0.6 เป็น 0.2 ครั้ง
ต่อ 100 ตำแหน่งคาสายสวน ($p = 0.02$) โดยที่พยาบาลมีการปฏิบัติตามชุดดูแลถูกต้องมากขึ้นจากร้อยละ
58.6 เป็นร้อยละ 77.3 ($p < 0.001$)

สรุปผลการศึกษา จากผลลัพธ์ที่ได้ การใช้ชุดการดูแลทำให้ลดภาวะแทรกซ้อนจากการใส่สายสวนหลอดเลือด
ส่วนปลายในผู้ป่วยเด็กและผู้ป่วยทารกได้ ดังนั้นควรส่งเสริมให้พยาบาลมีการปฏิบัติตามชุดการดูแลอย่าง
สม่ำเสมอ เพื่อความยั่งยืนในทางปฏิบัติและให้ได้ผลลัพธ์ที่ดีที่สุดในการให้การพยาบาล **เชียงใหม่เวชสาร 2557;
53(2):63-73.**

คำสำคัญ: ชุดดูแล สายสวนหลอดเลือดดำส่วนปลาย ผู้ป่วยเด็ก การปฏิบัติของพยาบาล

