

Effectiveness of ADULT Bundle to Prevention of Phlebitis

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Abstract: Phlebitis is the most common complication due to placement peripheral venous catheter. Prevention of phlebitis can reduce the length of stay and the cost from hospital. This study aims to examine the effectiveness of ADULT bundle to prevention of phlebitis. The research method used is quasi-experimental. The ADULT bundle is designed based on evidence based practice, which consists of; assessment, documentation, utility, line, technical prevention of phlebitis. The population in this study were patients who had peripheral venous catheter attached. Convenience sampling of 76 respondents was divided into 2 groups; control and intervention. Observation of signs and symptoms of phlebitis was carried out for 4 days with infusion nurses society phlebitis scale. The results showed that the application of the ADULT bundle was effective in preventing phlebitis ($p < 0.05$). It is hoped that nurses can apply the ADULT bundle in providing nursing care to patients who have peripheral venous catheter attached.

Keywords: ADULT Bundle, Prevention of Phlebitis, Peripheral Venous Catheter

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I. Introduction

Peripheral venous catheter placement is an invasive procedure that is most often performed in hospitalized patients, about half of patients receiving intravenous therapy during hospitalization (Chang and Peng, 2018). This procedure aims to replace fluids, blood or blood components, and give drugs intravenously to patients (López et al, 2014). Phlebitis is a complication due to intravenous therapy which is characterized by swelling, redness, infiltration (leakage of fluid from veins), fever, pain, local skin infections, and blood flow infections (Mihala et al, 2018).

Phlebitis is still a problem throughout the world. Data from the Centers for Disease Control and Prevention in 2017 shows that the incidence of phlebitis ranks fourth as an infection that is often found in patients during their stay in hospital. The highest incidence of phlebitis was found in developing countries such as India (27.91%), Iran (14.20%), Malaysia (12.70%), Philippines (10.10%), and Indonesia (9.80%).

Phlebitis is caused by mechanical, chemical, bacterial and postinfusion levels of phlebitis 0, 1, 2, 3, and 4. Factors that increase the risk of phlebitis include catheter material, catheter size, insertion factors (emergency situations, installation by inexperienced staff, installation of the lower limb), duration of catheter placement, IV fluid characteristics ($pH < 5$ or $pH > 9$, high osmolarity > 600 mOsm / L), patient's condition (fragile blood vessels, hypercoagulable state, high hemoglobin level, female sex, older age, underlying medical diseases namely diabetes mellitus, infectious diseases, cancer, immunodeficiency, peripheral blood vessels of poor quality (Gorski, 2018).

Nurses have important responsibilities in preventing phlebitis. One way to prevent phlebitis is to use a bundle approach. Bundle is a merging of evidence-based practice in everyday nursing practice (Saunders & Vehviläinen, 2016). Nursing practice with empirical evidence contributes to the quality of care and better outcomes for patients (Ray & Rickard, 2018).

The results of research conducted by Mestre et al (2013) with the maintenance bundle approach can reduce the incidence of phlebitis before the intervention 23.30% and after the intervention 12.10% ($p < 0.05$). Research by Rhodes et al (2016) with the insertion bundle and maintenance bundle approaches, the incidence of phlebitis was relatively decreased before the intervention 23.40% and after the intervention 7.90% ($p < 0.05$). Research by Yagnik et al (2017) with the insertion bundle approach and maintenance bundle, the incidence of phlebitis was relatively decreased before the intervention 3.70% and after the intervention 0% ($p = 0.08$).

The ADULT bundle approach consisting of assessment, documentation, utility, line, and prevention of phlebitis effectively prevents phlebitis in patients with peripheral venous catheter.

II. Method

The design used in this study was a quasi-experimental method with a nonequivalent control group posttest only design. The research was conducted at one of the hospitals in Medan in February to April 2019. The ethical clearance permit was obtained from the USU Faculty of Nursing Health Research Ethics Commission (Number: 1616 / II / SP / 2019). A total of 76 patients with peripheral venous catheter were divided into control and intervention groups. Inclusion criteria in this study are: 1) aged >18 years, 2) peripheral venous catheter >24 hours, 3) willing to be a respondent. Exclusion criteria were: 1) installation of peripheral venous catheter in an emergency with inappropriate aseptic techniques, 2) the laboratory confirmed blood flow infection (within 48 hours before), 3) mounted central venous catheter (CVC), 4) patients who received end of life care, 5) cognitive impairment, 6) were not willing to be respondents.

How to conduct research in the control group are: 1) before data collection, researchers conduct socialization using a video about the standard operational procedures (SPO) installation and IV catheter care according to hospital standards to nurses in the emergency room and inpatient, 2) researchers provide intervention namely the installation and treatment of peripheral venous catheter according to hospital standards, 3) after intervention, the respondent observes 1, 2, 3, 4 days for signs and symptoms of phlebitis using the Infusion Nurses Society (INS) Phlebitis Scale.

How to conduct research in the intervention group, namely: 1) researchers in collaboration with PT. Becton Dickinson Indonesia conducts IV catheter fitting and care training in accordance with the ADULT Bundle to nurses in the emergency room and inpatient, 2) the researcher provides an intervention that is the installation and treatment of peripheral venous catheter according to the ADULT bundle which consists of an assessment that is the assessment of the location of the insertion associated with signs of phlebitis, documentation on insertion and removal of peripheral venous catheter, utilities using IV catheters made of vialon material, closed system type infusion sets, and transparent dressing containing antimicrobials, lines by rinsing peripheral venous catheter access using sodium chloride 0.9% as much as 3 ml before and after administration of the drug, the prevention of phlebitis consists of hand hygiene with 6 steps and 5 moments, rubbing with alcohol swab and allow to dry for 30 seconds before insertion, not touching the disinfected area, fixation well, clean, not wet, rub the access catheter with an alcohol swab for 15 seconds before injection via a peripheral venous catheter.

The results of the study were analyzed by univariate and bivariate statistical tests. The univariate analysis used in this study was a descriptive analysis of the respondent's characteristics, namely sex, age, duration of catheter placement, type of fluid used, and chronic disease. Bivariate analysis tested with chi-square test which aims to determine the effectiveness of the application of hospital standards compared to the ADULT bundle.

III. Research Results and Discussion

3.1 Results

Characteristics of Respondents

Table 1 Characteristics of Respondents by Gender, Age, Duration of Catheter Installation, Type of Fluid Used, Chronic Disease in the Control and Intervention Groups (n = 76)

Characteristics	Control		Intervention	
	n	%	n	%
Gender				
Male	21	55,3	22	57,9
Female	17	44,7	16	42,1
Age				
<60 Years	17	44,7	20	52,6
≥60 Years	21	55,3	18	47,4
Duration				
<96 Hours	30	78,9	26	68,4
≥96 Hours	8	21,1	12	31,6
Type of Fluid				
Isotonic	23	60,5	30	78,9
Hypertonic	15	39,5	8	21,1
Chronic Disease				
No	12	31,6	18	47,4
Yes	26	68,4	20	52,6

Source: Research Results

Table 1 shows the distribution of respondents according to gender in the control group most male, at 55.3%, as well as the intervention group with the most male at 57.9%. The distribution of respondents according to age in the control group with the most age >60 years was 55.3%, while the intervention group with the most

age <60 years was 52.6%. The distribution of respondents according to the duration of catheter placement in the control group with the most <96 hours by 78.9%, as well as the intervention group with the most is <96 hours by 68.4%. Distribution of respondents according to the type of fluid used in the control group that most uses isotonic fluid by 60.5%, as well as in the intervention group that uses the most isotonic fluid by 78.9%. The distribution of respondents according to chronic diseases, namely hypertension and diabetes mellitus, in the control group that had the most chronic disease was 68.4%, as well as in the intervention group that had the most chronic disease at 52.6%.

Effectiveness of ADULT Bundle on the Incidence of Phlebitis

The results of this study indicate that there are differences in the application of hospital standards compared to the ADULT bundle on the incidence of phlebitis after being statistically tested using the chi-square test ($p < 0.05$) between the control and intervention groups ($p = 0.0001$) to the incidence of phlebitis in patients attached to peripheral venous catheter.

Table 2 Effectiveness of the ADULT Bundle Against the Incidence of Phlebitis in the Control and Intervention Group (n = 76)

Variabel	Intervention		Control		P-Value
	n	%	n	%	
Incidence of Phlebitis					
Yes	3	7,9	30	78,9	0,0001
No	35	92,1	8	21,1	

Source: Research Results

The results of the bivariate analysis showed that the incidence of phlebitis in patients with peripheral venous catheter found the majority of the control group had phlebitis as many as 30 people (78.9%). Whereas in the intervention group the majority did not occur as much as 35 people phlebitis (92.1%) with a value ($p = 0.0001$).

3.2 Discussion

Occurrence of Phlebitis After Application of Hospital Standards (Control Group)

From the results of the study found the incidence of phlebitis due to peripheral venous catheter placement in the control group that is after the application of hospital standards of 78, 9%. The occurrence of phlebitis occurred because there was no study related to the signs and symptoms of phlebitis at the time of installation and treatment of peripheral venous catheter. Most signs and symptoms of phlebitis are found when the nurse gives an injection of the drug. Assessment related to the condition of the dressing such as wet and dirty is rarely done so that there are many bandages that look dirty and are not replaced. This can cause phlebitis caused by bacteria. The documentation carried out in the control group is still simple, namely in the form of timely drug administration table. The nurse did not document the insertion related to the catheter number, insertion location, number of insertion attempts, difficulty when insertion, and when removing the catheter such as the date, time and reason for removing the peripheral venous catheter. This can cause difficulties for nurses when treating peripheral venous catheter which is when dressing dressing.

The equipment used in the control group is IV catheters made of Teflon material, open system type infusion sets, and transparent dressings that do not contain antimicrobials. IV catheters made of Teflon material have a micro-surface that is not smooth, not thermoplastic, not hydrophilic and less flexible so that the control group respondents experienced mechanical phlebitis on the second day after insertion. Open system type infusion sets cause internal pressure on the vein when the nurse gives the drug through peripheral venous catheter access. Transparent dressings that do not contain antimicrobials are more easily released because they are not semipermeable and cannot prevent microorganism contamination that can cause bacterial phlebitis.

The control group respondents were not rinsed with 0.9% NaCl before and after administration of the drug, so that drugs entering the blood vessels can damage the intima tunica and cause chemical phlebitis. The nurses' lack of knowledge about flushing before and after administering the drug makes nurses not do flushing at the time of injection of the drug.

Regarding the prevention of phlebitis prevention, the hand hygiene control group conducted was not based on the WHO standard in 2009, namely hand hygiene with 6 steps and 5 moments. Disinfection of the area to be inserted is carried out by moving back and forth repeatedly in less than 30 seconds, inserting without using an antiseptic solution, touching the insertion area with gloves and not rubbing the catheter access with alcohol swabs for 15 seconds before injection of drugs through a venous catheter peripheral. This can cause bacterial and chemical phlebitis because the action that gives the antiseptic solution not to dry before insertion can cause irritation when the antiseptic is drawn into the vein during insertion.

Occurrence of Phlebitis After Application of ADULT Bundle (Intervention Group)

This study has proven that the ADULT bundle is effective against the prevention of phlebitis in patients with peripheral venous catheter. The results showed that the ADULT bundle was effective in preventing the incidence of phlebitis, namely the incidence of phlebitis in the intervention group of 3 respondents (7.9%), compared to the control group of 30 respondents (78.9%), $p < 0.05$.

The advantage of the ADULT bundle is that interventions are designed based on evidence-based practice, which consists of assessment, documentation, utility, line, and phlebitis prevention techniques. Assessment interventions carried out in this study consisted of assessing the location of insertion of the signs and symptoms of phlebitis and the condition of the dressing for 4 days after insertion of peripheral venous catheter, if the dressing was wet or looked dirty then it was immediately replaced to prevent bacterial phlebitis. This is in line with research conducted by Webster, Northfield, Larsen, Marsh, Rickard & Chan (2018) about assessment, namely assessment of insertion sites related to clinical signs such as redness, swelling, fluid, pus. The results of this study indicate the assessment of insertion sites can prevent complications of local infection, allergic dermatitis or bandage irritation. This is confirmed by Yagnik et al's (2017) study that reported monitoring of peripheral intravenous cannula for signs and symptoms of phlebitis can reduce the incidence of phlebitis by 0% ($p < 0.08$).

Documentation carried out in the intervention group was to document the actions of nurses during insertion and removal of peripheral venous catheter in the ADULT prevention form for phlebitis. This activity is to determine the signs and symptoms of phlebitis so that prevention of phlebitis can be done immediately. In accordance with the results of research conducted by Upadhyaya, Hendra & Wilson (2018) with a low-tech intervention that is documentation stickers at the time of insertion of peripheral venous catheter placed on all anesthetic charts. This intervention can improve documentation of peripheral venous access and compliance with care standards.

Regarding utility, researchers used equipment based on evidence based practice in the intervention group, namely IV catheters made from vialon material, closed system type infusion sets, and transparent dressings containing antimicrobials. Catheters made of silicone elastomer and polyurethane (vialon) have smoother micro surfaces, are thermoplastic, more hydrophilic, become more flexible than polytetrafluoroethylene (teflon) at body temperature, and cause less venous irritation (Gorski, 2018). This is in line with the results of research conducted by Chhugani, James, and Thokchom (2015), the average incidence of phlebitis was 0.23% in subjects using vialon catheter material compared to 0.48% using polytetrafluoroethylene (teflon) catheter material.

The use of an integrated catheter (closed system) reduces the internal pressure on the vein that arises when the nurse manipulates the catheter to connect the extension set and reduces the movement of the catheter to the internal vein wall due to a special port located at the upstream of the catheter that functions as the injection site. Reducing the movement of the catheter can reduce irritation to the tunica intima of blood vessels. This technology can also reduce the risk of contamination and infection, reduce external pressure on veins, reduce irritation, phlebitis, internal swelling and occlusion (Castillo, MI et al., 2018). In line with the results of research conducted by Lopez, Vilela, del Palacio, Corral, Marti, and Portal, (2014) using a closed system can reduce the incidence of phlebitis by 29%.

Transparent dressings containing antimicrobials can prevent contamination by microorganisms through the (1) extraluminal route, ie patient skin organisms in the insertion area migrate along the surface of the catheter into the catheter channel resulting in colonization at the end of the catheter, (2) intraluminal ie direct contamination at the catheter or the point where also along the fluid pathway when the intravenous system is manipulated as officers make hand contact with peripheral venous catheter access when administering drugs with non aseptic techniques (Asia Pacific Society of Infection Control / APSIC, 2015). In line with the results of research conducted by Daniels & Frei (2012) that antimicrobial dressings are effective in preventing and reducing the colonization of skin microorganisms around the insertion area.

The line intervention in this study was rinsing access to peripheral venous catheter with 0.9 ml NaCl solution as much as 3 ml before and after drug injection. In accordance with the results of research conducted by Keogh, Flynn, Marsh, Mihala, Davies & Rickard (2016) by rinsing access to peripheral venous catheter using 0.9% NaCl solution as much as 3-10 ml before and after drug administration can prevent phlebitis.

Technic prevention of phlebitis performed in the intervention group includes: (1) hand hygiene with 6 steps and 5 moments, (2) rubbing with alcohol swabs and allow to dry for 30 seconds before insertion, (3) not touching the disinfected area, (4) fixation well, clean, not wet, (5) rub the access catheter with alcohol swab and let it dry for 15 seconds before injection through peripheral venous catheter effectively prevent the incidence of phlebitis in patients with peripheral venous catheter attached. In line with research conducted by Crowell, O'neil & Drager (2017) states the HANDS bundle approach consists of hand hygiene, antisepsis, "no-touch" technique, documentation of insertion location, daily inspection by infusion nurses, giving dates to dressings and tubing for all infusions, disinfection of infusion access, can reduce the rate of phlebitis consistently to 2%.

IV. Conclusion and Suggestion

4.1 Conclusion

Based on the results of this study it can be concluded that there are differences in the application of catheter IV installation and treatment based on hospital standards compared to the ADULT bundle on the incidence of phlebitis ($p = 0.0001$). So that the application of ADULT bundle is more effective in preventing the incidence of phlebitis compared to hospital standards.

4.2 Suggestion

Education

The results of the study can be one of the skills laboratory material and equip students with workshops or training.

Nursing Services

It is expected that policy makers in nursing service facilities can apply the ADULT bundle integrated with nursing care for patients with peripheral venous catheter.

Research

The next recommended study is the effectiveness of the ADULT bundle on length of stay, cost of care and patient satisfaction with peripheral venous catheter.

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