

# ประสิทธิผลของแนวทางการพยาบาลเพื่อป้องกันตกเลือดหลังผ่าตัดคลอด ต่อปริมาณการสูญเสียเลือดและอัตราการเกิดตกเลือดหลังผ่าตัดคลอด

## Effectiveness of Nursing Guideline to Prevent Postpartum Hemorrhage on Blood Loss and Rate of Postpartum Hemorrhage after Cesarean Section

นิพนธ์ต้นฉบับ

Original Article

จ.ไรรัตน์ มีทิพย์กิจ<sup>1</sup> และ ทิพวรรณ เอี่ยมเจริญ<sup>2\*</sup>

<sup>1</sup> โรงพยาบาลพรดิประชาติ ถนนพญาไท กรุงเทพมหานคร 10230

<sup>2</sup> สาขาวิชาการพยาบาลมารดา ทารกและการผดุงครรภ์ คณะพยาบาลศาสตร์ มหาวิทยาลัยศรีนครินทรวิโรฒ อ.องครักษ์ จ.นครนายก 26120

\* Corresponding author: tippawani@g.swu.ac.th

วารสารไทยเภสัชศาสตร์และวิทยาการสุขภาพ 2563;15(2):81-89.

Jurairut Meetipkit<sup>1</sup> and Tippawan Iamchareon<sup>2\*</sup>

<sup>1</sup> Nopparat Ratchathani Hospital, Khannayao, Bangkok 10230, Thailand

<sup>2</sup> Department of Maternal Care and Midwifery, Ongkharak, 26120, Thailand

\* Corresponding author: tippawani@g.swu.ac.th

Thal Pharmaceutical and Health Science Journal 2020;15(2):81-89.

### บทคัดย่อ

### Abstract

**วัตถุประสงค์:** เพื่อประเมินผลการใช้แนวทางการพยาบาลเพื่อป้องกันตกเลือดหลังผ่าตัดคลอด ต่อปริมาณการสูญเสียเลือดและอัตราการเกิดตกเลือดหลังผ่าตัดคลอด ระหว่างกลุ่มก่อนและหลังการใช้แนวทางการพยาบาล **วิธีการศึกษา:** กลุ่มตัวอย่างคือมารดาหลังผ่าตัดคลอดที่เข้ารับการรักษาในหอผู้ป่วยสูติ-นรีเวชกรรมสามัญ โรงพยาบาลแห่งหนึ่ง ตั้งแต่เดือนกรกฎาคมถึงธันวาคม 2561 แบ่งเป็นกลุ่มควบคุม 60 ราย และกลุ่มทดลอง 66 ราย เครื่องมือที่ใช้ในการวิจัยประกอบด้วย 1) แนวทางการพยาบาลเพื่อป้องกันตกเลือดหลังผ่าตัดคลอด 2) แบบประเมินความเสี่ยงต่อการตกเลือดหลังผ่าตัดคลอด และ 3) แบบบันทึกข้อมูลการตกเลือดหลังผ่าตัดคลอดจากเวชระเบียน แบบประเมินความเสี่ยงต่อการตกเลือดหลังผ่าตัดคลอดมีความตรงเชิงเนื้อหา (CVI = 0.93) วิเคราะห์ข้อมูลโดยใช้สถิติเชิงบรรยาย และทดสอบสมมติฐานการวิจัยด้วยสถิติ Mann-Whitney U test และ Chi-square test **ผลการศึกษา:** มารดาหลังผ่าตัดคลอดกลุ่มทดลองมีค่าเฉลี่ยปริมาณการสูญเสียเลือดหลังผ่าตัดต่ำกว่ากลุ่มควบคุมอย่างมีนัยสำคัญทางสถิติ ( $P$ -value < 0.001) และไม่เกิดภาวะตกเลือดหลังผ่าตัดคลอด ส่วนกลุ่มควบคุมมีภาวะตกเลือดหลังผ่าตัดคลอด 1 ราย อัตราการเกิดตกเลือดหลังผ่าตัดคลอดรายใหม่ในสองกลุ่มไม่ต่างกัน **สรุป:** การใช้แนวทางการพยาบาลเพื่อป้องกันตกเลือดหลังผ่าตัดคลอดสามารถเพิ่มคุณภาพในการป้องกันการตกเลือดหลังผ่าตัดคลอดได้

**Objective:** To evaluate the effectiveness of nursing guideline to prevent postpartum hemorrhage on the amount of blood loss and the rate of the hemorrhage after Cesarean section between groups before and after using the guideline. **Method:** The sample consisted of mothers undergone Cesarean section who were admitted to the obstetric and gynecological ward of a hospital from July to December 2018. A total of 60 mothers were in the control group and 66 in the test group. The research instruments consisted of 1) a nursing guideline for preventing postpartum hemorrhage, 2) risk assessment checklist for post-Cesarean section hemorrhage, and 3) data collection form of postpartum hemorrhage from medical records. Risk assessment checklist had a high level of content validity (CVI = 0.93). Descriptive statistics, Mann-Whitney U test and Chi-square test were used in data analysis. **Results:** The test group had a significantly lower mean post-operative blood loss than the control group ( $P$ -value < 0.001). No post-operative hemorrhage in the test group and 1 in the control group were found. Rates of new postpartum hemorrhage in the two groups were not different. **Conclusion:** Nursing guidelines to prevent postpartum hemorrhage could improve quality of post Cesarean section hemorrhage prevention.

**คำสำคัญ:** แนวทางการพยาบาล, ป้องกันตกเลือดหลังผ่าตัดคลอด, มารดาผ่าตัดคลอด, อัตราการตกเลือดหลังผ่าตัดคลอด

**Keyword:** nursing guideline, post-Cesarean section hemorrhage, Cesarean section, rate of post cesarean section hemorrhage.

#### Editorial note

Manuscript received in original form on November 3, 2019;  
revised December 28, 2019;  
and accepted in final form on January 2, 2020

Journal website: <http://ejournals.swu.ac.th/index.php/pharm/index>

## Introduction

Cesarean section has been increasing worldwide recently. In Thailand, the rate of Cesarean section had been increasing from 23.20% in 2009 to 32.50% in 2017, with the rate of postpartum hemorrhage of 2.30% to 3.10%, respectively.<sup>1</sup> Postpartum hemorrhage is a common delivery complication and has been the worldwide cause of maternal death among as high as 25% especially in developing countries of which a range of 24.5 – 39.9% has been reported.<sup>2</sup> In Thailand, from 2009 to 2017, postpartum hemorrhage had been found 28 – 33 per 100,000 live births.<sup>1</sup>

Postpartum hemorrhage affects physical and mental health of the mother. Physically, shock due to blood loss leads to a higher chance of critical care unit admission<sup>3</sup>, longer rehabilitation time, and poorer newborn care.<sup>4</sup> Psychologically, postpartum depression and other mental illnesses could follow severe postpartum hemorrhage.<sup>5</sup> The Ministry of Public Health of Thailand has set the goal for the healthcare for female adolescents and women aiming to decrease the postpartum maternal mortality of less than 15 per 100,000 live birth.<sup>6</sup>

Hence, efforts from all responsible parties should be put forth to prevent postpartum hemorrhage.

Postpartum ward is responsible for taking care of the mother undergone Cesarean section with and without complication. In Thailand, based on the data from the fiscal years of 2015 to 2017, rate of Cesarean section had been increasing from 33.62% to 35.14% and 33.33%, respectively with the obvious increasing rates of postpartum hemorrhage of 1.16% (21 cases) to 2.78% (60 cases) and 5.97% (107 cases), respectively.<sup>7</sup> In addition, recurrent postpartum hemorrhage at the postpartum ward was found in be 8, 14 and 18 cases, respectively; shock requiring transfusion of blood or blood components and unplanned critical care admission in 3, 7 and 10 cases, respectively; and postpartum hysterectomy in 3, 3 and 10 cases, respectively.<sup>7</sup>

Nopparat Ratchathani Hospital set the guideline for assessment, referral, and care for the mother with the risk of postpartum hemorrhage to prevent such hemorrhage to be less than 2% since the fiscal year of 2013. However, despite such plan, postpartum hemorrhage the rate of postpartum hemorrhage had been increasing.

In Thailand, risk factors of postpartum hemorrhage include the mother age of greater than 35 years, foreigners (Myanmar or Cambodia nationality), having at least one pregnancy, having placenta previa, emergency Cesarean section, abnormal second stage of labor<sup>8</sup>, receiving general anesthesia, and newborn with the body weight of more than 3,600 grams.<sup>8,9</sup>

It has been found that education level, skills and training of the nurse regarding postpartum hemorrhage management were associated with less severe postpartum hemorrhage.<sup>10</sup> Previous research indicated that nursing guideline to prevent postpartum hemorrhage in the first stage labor in mothers with normal delivery could effectively reduce the incidence,<sup>11,12</sup> with no shock from blood loss, hysterectomy from blood loss, or maternal mortality due to the hemorrhage.<sup>12,13</sup> These findings indicated that prompt, proper post-labor support could reduce the risk of postpartum hemorrhage and death relating to the hemorrhage. However, there have been no studies on nursing guideline to prevent postpartum hemorrhage after Cesarean section. The authors would like to develop and test the effectiveness a nursing guideline to prevent postpartum hemorrhage after Cesarean section. Specifically, we examined the effect of nursing guideline on the volume of blood loss within 24 hours post-delivery and rate of

postpartum hemorrhage among Cesarean section cases and recurrent postpartum hemorrhage in the postpartum ward. This study compared the two outcomes between the test and control groups. The findings could help guide the future nursing care for mothers with post-Cesarean section.

## Methods

In this experimental study, the design was guided by the Conduct and Utilization Research in Nursing (CURN model).<sup>14</sup> Based on the CURN model, 1) problems of nursing care to prevent postpartum hemorrhage were systematically specified, 2) knowledge and findings are reviewed and evaluated from previous research and documents, 3) innovation is developed (in this case, the nursing guideline), 4) clinical trial is conducted, 5) hypothesis is rejected or accepted, 6) the innovation is disseminated, and 7) ultimately the innovation is updated to be sustainable.

In this clinical study, the first five steps of CURN model were followed so that the nursing guideline to prevent postpartum hemorrhage was developed and tested in a clinical trial. Problems and relating causes regarding the patient, as well as the nurse and the care they provided were systematically identified and analyzed. Evidences from documents and research were searched, analyzed and synthesized. Necessary tools were developed including the questionnaire to assess risk of postpartum hemorrhage, postpartum hemorrhage (PPH) kit, and cold compress belly band. Pilot test of such instruments was conducted before the actual clinical trial. In the clinical trial, the risk of postpartum hemorrhage was evaluated and cold compress belly band was applied for mothers with moderate to high risk of postpartum hemorrhage. Volume of blood loss was also recorded. Finally, all hypotheses were tested and conclusion was made

In the experimental study, two groups of the mother were prospectively followed on non-parallel time intervals (prospective interrupt time design) where the trial among women receiving the usual nursing care was conducted first.

Study population was mothers who had been undergone Cesarean section and stayed in the postpartum ward of Nopparat Ratchathani Hospital between July and December 2018. For the study sample, individuals in the study population were selected based on the inclusion criteria of age of 20 years or older, being able to communicate in Thai, and willing

to participate in the study. A total of 126 mothers participated in the study.

### Research instruments

Instruments in the study included the intervention tools and data collection forms. For the interventions, the nursing guideline to prevent postpartum hemorrhage was developed by the investigators from the existing guideline of Nopparat Ratchathani Hospital with guidelines to prevent postpartum hemorrhage of MPQC and WHO. The questionnaire to assess risk of postpartum hemorrhage was modified from the WHO recommendations for the prevention and treatment of postpartum hemorrhage<sup>3</sup> with the use of the cold compress belly band to stimulate uterine contraction in cases with moderate to high risk of postpartum hemorrhage. The postpartum hemorrhage (PPH) kit containing medical devices and products to alleviate bleeding, and products and devices for parenteral administration, blood transfusion, and oxygenation was developed. The nursing guideline was developed with the following three phases.

### Development of nursing guideline to prevent postpartum hemorrhage

The development of the nursing guideline to prevent postpartum hemorrhage was carried out in the **four steps** as follows. In the **first step**, problems and related causes of postpartum hemorrhage were systematically identified and analyzed regarding the patient, the nurse and their nursing care. On the patient side, 92 cases of postpartum hemorrhage in the fiscal year of 2017 were analyzed. It was found that factors associating with postpartum hemorrhage included having general anesthetics, having planned Cesarean section, hematocrit concentration before operation of less than 33%, and the mother age of 35 years or older (based on Pearson's correlation coefficients, with P-value of 0.011, 0.02, 0.05, and 0.03. Regarding the nurse, problems about postpartum maternal care reported in the nurse meeting were that periodic monitoring of signs and symptoms of every 15 minutes for 4 times and every 30 minutes for 2 times was insufficient and the existing nursing care had protocol to assess and grade the risk of postpartum hemorrhage for mothers with Cesarean section. These delayed the assessment and assistance once the hemorrhage occurred.

In the **second step**, the analysis on evidence from documents and research found that there was a guideline for postpartum hemorrhage of the Mississippi Perinatal Quality Collaborative (MPQC).<sup>15</sup> In the MPQC, nursing protocol called the toolkit was defined as 4-R's including 1-Readiness, 2-Recognition and Prevention, 3-Response, and 4-Reporting/Systems Learning.

For **Readiness**, all units responsible for post-delivery maternal care need to be ready which means 1) having cart for emergency care for blood loss, and a checklist and devices for balloons compression, 2) having medication box for the emergency treatment of blood loss readily available, 3) having the emergency team for postpartum hemorrhage, 4) determining protocol for giving blood and blood components and fast access to blood bank, and 5) training the team emergency team for postpartum hemorrhage for a prompt assistance.

In the **Recognition and Prevention** component of the MPQC, nurses need to recognize the situation of and the prevention for postpartum hemorrhage. This could be done through the protocol of 1) having the monitoring system for early warning signs and symptoms to prompt nurses for close monitoring and care, 2) assessing the risk of postpartum hemorrhage in all cases, 3) having instruments and medications readily available for high risk group, and 4) having accurate blood loss volume measurement. For monitoring system, these warning signs and symptoms include systolic blood pressure of  $< 90$  or  $> 160$  mmHg, diastolic blood pressure of  $< 60$  or  $> 100$  mmHg, heart rate of  $< 50$  or  $> 120$  bpm, respiratory rate of  $< 10$  or  $> 30$  breath per minute, pulse oxygen saturation with no oxygenation of  $< 95\%$ , and urine output within 2 hours of less than 50 mL per hour. For the assessment on the risk of postpartum hemorrhage, risk factors to be evaluated for each risk group are as follows. In the low risk group, risk factors are no history of hysterectomy, singleton pregnancy, history of less than 4 vaginal deliveries, no abnormal bleeding, and no history of postpartum hemorrhage. For moderate risk group, risk factors include history of Cesarean section or hysterectomy, twin pregnancy, history of more than 4 vaginal deliveries, chorioamnionitis, history of postpartum hemorrhage, and myoma uteri. The high risk group are those who have placenta previa, suspected placenta adherent, hematocrit of less than 30%, platelet count of less than  $100,000 /\text{mm}^3$ , severe blood loss at admission, and history of abnormal coagulation. For instruments and

medications, the supply should be checked and replenished for prompt use especially for the mother with high risk. Finally, blood loss volume could be measured accurately using measuring bag or weighing blood-soaked cloth or sanitary pads.

In terms of **Response**, nursing care must be carried out promptly once postpartum hemorrhage occurs. Steps of nursing care should be clearly shown in order and specific responsibility of the nurse during and after the blood loss must be stated. Technically, balloon containing cold sterile saline could be used as compression device to stop bleeding in the uterine during and after operation. This resulted in an effective reduction in volume of blood transfusion, post-operative infection, length of hospital stay, and postpartum hemorrhage.<sup>16</sup>

For **Reporting/Systems Learning**, methods of effective shared learning, documenting and reporting should be determined so that amendment and development could be done in a timely fashion.

In the **third step** of the development of the nursing guideline, we developed the checklist to assess the risk of postpartum hemorrhage, PPH kit, and cold compress belly band. The checklist was developed as guided by the WHO guideline<sup>3</sup> with the Florida Perinatal Quality Collaborative (MPQC).<sup>17</sup> Problems found in the existing nursing care were used to guide developing new nursing activities for maternal care who had undergone Cesarean section. To make the cold compress belly band, a cold gel pack was wrapped with a clear plastic bag, then put in a cloth bag for securing around the belly. As guided by previous research<sup>16</sup>, this band was expected to compress and stimulate the uterine contraction in women with moderate to high risk of postpartum hemorrhage.

In the **fourth step**, the instruments for intervention were pilot-tested before the actual experiment. Nurses were invited to the meeting to be familiar with the new nursing care guideline and devices. Pilot test was done in five mothers undergone Cesarean section. It was found that in the risk checklist, the risk factors of BMI  $\geq 30$  kg/m<sup>2</sup> and newborn body weight of  $\geq 4,000$  grams were not suitable for categorizing BMI of Thai women and newborns. As a result, the cutoff for the mothers was modified to BMI  $\geq 25$  kg/m<sup>2</sup> and the one for the newborn body weight was modified to  $\geq 3,600$  grams.

In our daily practice, the cold compress belly band was used in all mothers with poor uterine contraction regardless of the risk of postpartum hemorrhage. It was found that no

benefit was found among those with low risk. Therefore, in this experiment the cold compress belly band was used in cases with moderate to high risk of postpartum hemorrhage. This new guideline was tested in the clinical trial.

### **The clinical trial conduct**

In the clinical trial, the control group where the usual nursing care to prevent postpartum hemorrhage was given to mothers who had been undergone Cesarean section operation was conducted from July to September, 2018. Later on, from October to December, 2018, we conducted the test group trial where the intervention of the new nursing care guideline to prevent postpartum hemorrhage was provided. The study flow in the two groups is shown in Figure 1.

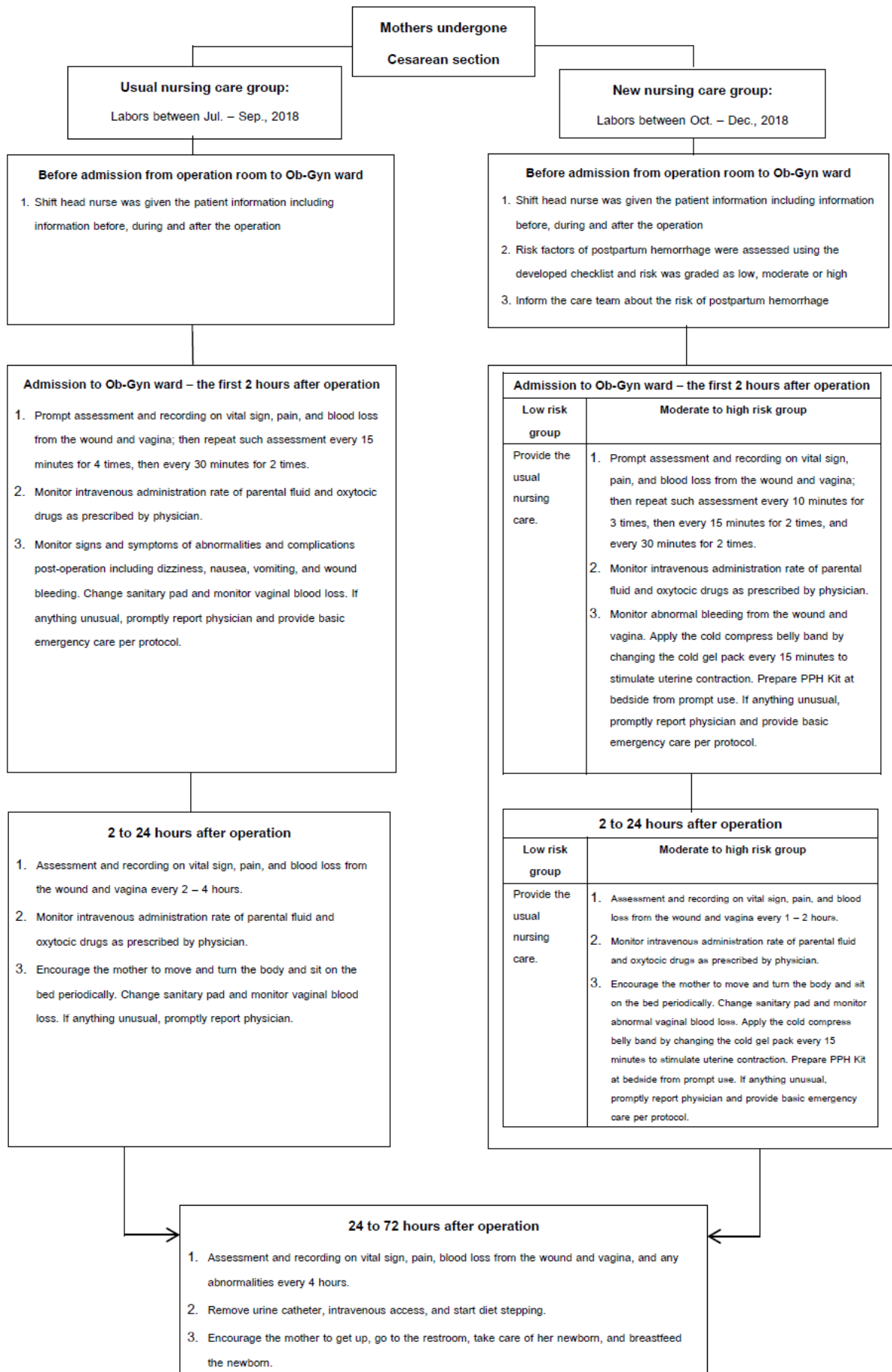
The outcomes of the study were assessed at the discharge from the hospital. The data were extracted from the medical record. The outcomes included volume of blood loss within 24 hours after Cesarean section operation and rate of postpartum hemorrhage among women undergone Cesarean section both cases of new and recurrent bleeding in the postpartum ward.

### **Data collection instruments**

In this study, the checklist to assess the risk of postpartum hemorrhage and the data collection form for postpartum hemorrhage were examined for content validity by three experts including an obstetric-gynecology physician, a nursing instructor of maternal care and midwifery, and a professional nurse of postpartum ward. The checklist of postpartum hemorrhage risk was found to have a high content validity with a content validity index (CVI) of 0.93.

### **Participant right protection**

The study was approved by the Ethics Committee of Nopparat Ratchathani Hospital, Bangkok (Approval number: 32/2561, approval date: September 5, 2018). The investigators conducted the research according to participant right protection standards. After approval granted, the investigators met individual potential participants to provide detail of the study, advantages and disadvantages of the participation, and assistance while participating. The participants could withdraw from the study at any time point with no effects on the care they received. Once written consent was obtained, the investigators started to collect data from the patient's medical record.



**Figure 1** Study profile of the experiment phase.

## Data collection procedure

The study was conducted as depicted in Figure 1. The shift head nurse evaluated and identified the risk of postpartum hemorrhage and recorded all other physical examinations. Nurses in the care team provided nursing care as guided by the protocol of either the study or control group. If any moderate to high risk of hemorrhage was identified, the nurse applied the cold compress belly band and followed the nursing protocol according to the protocol. The investigators collected demographic, nursing care and hemorrhage data from the medical record at the third day after the operation or before discharge.

## Data analysis

Demographic, history of pregnancy and Cesarean section, volume of blood loss after operation, and rate of postpartum hemorrhage data were presented using descriptive statistics including frequency with percentage and mean with standard deviation. Differences of continuous variable means between the two groups was tested using independent t-test or Mann-Whitney U test, as appropriate; while differences in proportions between the two groups were tested using Chi-square or Fisher's exact test, as appropriate. Significance for all statistical analyses was set at a type I error of 5% or *P*-value < 0.05.

## Results

Of a total of 126 mothers, 60 of them were in the control group while the rest 66 were in the test group. Differences of participants in the two groups were not statistically significant in any aspects. The majority in both groups was in their 20 – 35 years of age with mean age of  $30.23 \pm 6.59$  and  $28.41 \pm 6.64$  years in control and test groups, respectively. The majority in both groups was Thai, with high school education and labor job. In terms of health status, the majority in both groups had no co-morbidity, no history of Cesarean section, and normal BMI (i.e., 18.5-22.9 kg/m<sup>2</sup>) with an average BMI of  $23.64 \pm 4.78$  and  $23.80 \pm 0.69$  kg/m<sup>2</sup>, respectively. The majority was in the category of 2<sup>nd</sup> to 4<sup>th</sup> gestation, delivered their 2<sup>nd</sup> child or greater, and had gestational age in the category of 37 – 42 weeks with a mean of  $38.37 \pm 1.64$  and  $38.47 \pm 1.99$  weeks, respectively. The majority in both groups had no health problem or anemia while pregnant, and had Cesarean section for the indication of failure to progress or cephalopelvic disproportion. All of them had general

anesthetics and the majority had low vertical incision and went for 30 – 60 minutes in operation with an average of  $44.83 \pm 10.73$  and  $43.12 \pm 11.11$  minutes, respectively.

**Table 1** Demographic and clinical characteristics of the participants (N = 126).

Characteristics	Control group (n = 60)		Test group (n = 66)		P-value*
	Number	%	Number	%	
<b>Age (yrs)</b>					
20 - 35	44	73.33	52	78.79	0.473
≥ 35	16	26.67	14	21.21	
min - max	20 - 43		20 - 41		
mean ± SD	30.23 ± 6.565		28.41 ± 6.642		
<b>Nationality</b>					
Thai	41	68.33	40	60.61	0.339
Others	19	31.67	26	39.39	
<b>Education</b>					
No formal education	6	10.0	15	22.7	0.238
Primary school	18	30.0	19	28.8	
High school or higher	36	60.0	32	48.5	
<b>Occupation</b>					
Not working	20	33.3	28	42.4	0.338
Labor	32	53.3	27	40.9	
Employee of government/private sector	8	12.14	11	16.7	
<b>Co-morbidity</b>					
No	53	88.33	59	89.39	0.693
Yes	7	11.67	7	10.61	
<b>History of operation Cesarean section / curettage</b>					
Never	45	75.0	41	62.1	0.367
Cesarean section	11	18.3	16	24.3	
Curettage	4	6.7	9	13.6	
<b>Body mass index (kg/m<sup>2</sup>)</b>					
Thin (< 18.50)	4	6.7	3	4.5	0.897
Normal (18.5 - 22.9)	30	50.0	34	51.5	
Higher than normal (23.0 - 24.9)	7	11.7	5	7.6	
Obese (> 25.0)	19	31.6	24	36.4	
min - max	15.82 - 39.79		14.88 - 36.85		
mean ± SD	23.64 ± 4.783		23.80 ± 4.692		
<b>Number of gestation</b>					
1 <sup>st</sup>	24	40.0	20	30.3	0.570
2 <sup>nd</sup> - 4 <sup>th</sup>	36	60.0	44	66.7	
5 <sup>th</sup> or higher	-	-	2	3.0	
<b>Number of delivery</b>					
First delivery	28	46.7	26	39.4	0.601
Second delivery or higher	32	53.3	38	57.6	
<b>Gestational age at delivery (weeks)</b>					
< 37	8	13.3	5	7.6	0.289
37 - 42	52	86.6	61	92.4	
min - max	34-41		28-41		
mean ± SD	38.37 ± 1.636		38.47 ± 1.994		
<b>Health problem during pregnancy</b>					
No	49	81.7	44	66.7	0.121
Anemia / thalassemia carrier	4	6.7	3	4.5	
Gestational hypertension	5	8.3	9	13.6	
Gestational diabetes mellitus	2	3.3	10	15.2	
<b>Indication for Cesarean section</b>					
Failure to progress/ cephalopelvic disproportion	23	38.4	28	42.4	0.075
Previous Cesarean section	17	28.3	20	30.3	
Severe preeclampsia/eclampsia	4	6.7	8	12.1	
Breech/transverse or oblique lie	8	13.4	4	6.2	
Fetal distress/post-term labor	7	11.7	3	4.5	
Others (twins / premature rupture of membranes > 18 cm.)	1	1.7	3	4.5	
<b>Anesthetics during operation</b>					
General anesthetic with ET-tube	60	100	66	100	
<b>Type of incision</b>					
Low transverse	14	23.3	15	22.7	0.551 <sup>†</sup>
Low vertical	46	76.7	51	77.3	
<b>Operation duration (minute)</b>					
< 30	7	11.7	12	18.2	0.360
30 - 60	52	86.7	51	77.3	
> 60	1	1.7	3	4.5	
min - max	25-75		19-85		
mean ± SD	44.83 ± 10.734		43.12 ± 11.111		

\* Chi-squares test; <sup>†</sup> Fisher's exact test.

It was found that blood loss within the first 24 hours after the operation in the test group ( $16.67 \pm 36.98$  mL) was lower than that in the control group ( $23.33 \pm 180.74$  mL) with statistical significance ( $P$ -value  $< 0.001$ , Mann-Whitney U test) (Table 2). For the second outcome, rate of new postpartum hemorrhage in the test group (0%) was comparable with that in the control group (1.37%) with no statistical significance ( $P$ -value = 0.476, Fisher's exact test).

**Table 2** Outcomes of nursing guideline on postpartum hemorrhage among women undergone Cesarean section (N = 126).

Outcomes	Control group (n = 60)		Test group (n = 66)		P-value
	Number	%	Number	%	
<b>Volume of blood loss after operation (mL)</b>					
0 - 100	59	98.33	63	95.45	
101 - 200	-	-	3	4.55	
> 200	1	1.67	-	-	
min - max	0 - 1,400		0 - 200		
mean $\pm$ SD	23.33 $\pm$ 180.74		16.67 $\pm$ 36.98		< 0.001*
<b>New hemorrhage after Cesarean section</b>					
Yes	1	1.67	0	0	0.476 <sup>#</sup>
No	59	98.33	66	100	
<b>Hematocrit (%)</b>					
Not investigated	53	88.33	61	92.42	
25.01 - 32.99	6	10.00	2	3.03	
$\geq 33$	1	1.67	3	4.55	
min - max	27.30 - 36.80		30.30 - 36.40		
mean $\pm$ SD	30.23 $\pm$ 3.32		33.16 $\pm$ 2.53		

\* Mann-Whitney U test.

<sup>#</sup> Fisher's exact test.

**Table 3** Risk factors of postpartum hemorrhage after Cesarean section among the participants with various risk levels (N = 126).

Risk factors	Control group (n = 60)		Test group (n = 66)	
	Number	%	Number	%
<b>Risk of postpartum hemorrhage after Cesarean section</b>				
Low	50	83.33	58	87.87
Moderate	2	3.33	3	4.55
High	8	13.33	5	7.58
<b>Low risk factors</b>				
No history of Cesarean section	45	75.00	41	62.12
Singleton pregnancy	59	98.33	63	95.45
Vaginal delivery of < 4 times	40	66.67	28	42.42
No abnormal bleeding	60	100.00	66	100.00
No history of postpartum hemorrhage	60	100.00	66	100.00
<b>Moderate risk factors</b>				
History of hysterectomy or Cesarean section	11	18.33	17	25.76
Delivery of $\geq 4$ times	2	3.33	1	1.52
Newborn's body weight of > 4,000 grams	4	6.67	2	3.03
Obesity (body mass index of > 25 kg/m <sup>2</sup> )	19	31.67	24	36.36
Anemic while pregnant or delivery (hematocrit <30%)	4	6.67	3	4.55
Receiving general anesthetics	58	96.67	66	100.00
Blood loss during operation of $\geq 800$ mL	8	13.33	5	7.58
<b>High risk factors</b>				
Having placenta previa	1	1.67	-	-
Having placenta adherent	-	-	-	-
Platelet of < 70,000/mm <sup>3</sup> or abnormal coagulation	-	-	-	-
Having at least 3 moderate risk factors	8	13.33	5	7.60

In terms of risk of postpartum hemorrhage, the majority of the mothers had low risk (87.87%) followed by high risk (13.33%) (Table 3). Among those with low risk, no history of abnormal bleeding and no history of postpartum hemorrhage were found the most (100.00% for both factors and in both groups). For those with moderate risk, receiving general anesthetics was the most found factor (96.67% and 100.00% in control and test groups, respectively), followed by obesity and history of hysterectomy or Cesarean section. Finally, among the high risk group, having at least 3 moderate risk factors was the most found risk factor (Table 3).

## Discussions and Conclusion

The checklist in the nursing guideline could be used to better identify the risk of postpartum hemorrhage. In the test group, there were 3 (4.55%) and 5 (7.58%) mothers with moderate and high risk of postpartum hemorrhage, respectively. The most found risk factor for those with moderate risk was receiving general anesthetics. With its relaxation on smooth muscle including blood vessels and uterine, general anesthetics is associated with a higher risk of postpartum hemorrhage than local anesthetics.<sup>9,18</sup> Mothers with history of hysterectomy or Cesarean section are more likely to have scars on the uterine membrane which could make the uterine ruptured or broken and ultimately a higher risk of postpartum hemorrhage.<sup>18,19</sup> In addition, a history of Cesarean section is associated with a higher risk of connective membrane adhesion in the abdominal cavity.<sup>20</sup> This connect membrane could make the future Cesarean section more difficult and the hemorrhage is more likely.

In terms of body mass index, the study of Blomberg found that 8 – 13% of obese mothers (BMI of  $\geq 30$  kg/m<sup>2</sup>) faced postpartum hemorrhage.<sup>21</sup> This could be due to the fact that they are more likely to need heparin-like medication throughout their pregnancy which could further lead to hemorrhage while delivery either in vaginal labor or Cesarean section. Sebire and colleagues also found that mothers with BMI of > 36.0 kg/m<sup>2</sup> had a 1.16 times risk of postpartum hemorrhage of those non-obese.<sup>22</sup> This suggests that the mother health status information could help nurses to identify risk of postpartum hemorrhage which could further prompt appropriate nursing care to effectively prevent and alleviate the hemorrhage in a timely fashion.

In our study, a total of 8 mothers, 5 and 3 with high and moderate risk of postpartum hemorrhage, respectively, were taken care of according to the developed nursing guideline for prevention of postpartum hemorrhage. One of the 8 mothers had poorly contracting uterine and was applied with cold compress belly band to stimulate uterine contraction. Being closely monitored for vital sign according to the newly developed nursing guideline, this patient lost about 200 mL of blood within the first 24 hours after the operation with no postpartum hemorrhage. This kind of circumstance was also reported in the study of Cheng and colleagues where sterile saline in a cool balloon to stop uterine bleeding while suturing up the incision, to compress wound bleeding after operation so that blood loss after operation, postpartum hemorrhage, and post-operative infection could be reduced.<sup>16</sup>

Among mothers receiving the usual nursing care in our study, once post hoc analysis of risk level was done, it was found that 2 and 8 mothers had moderate and high risk of postpartum hemorrhage or 3.33% and 13.33%, respectively. One case of postpartum hemorrhage was found with a total of 1,400 mL within the 24 hours after operation. In terms of complications relating to postpartum hemorrhage, our study found only mild anemia with no severe complications like severe anemia (Hct of 25% or lower), hysterectomy after delivery, or shock or death from postpartum hemorrhage. This was also consistent with previous studies where nursing care to prevent postpartum hemorrhage among normal delivery could reduce post-operative bleeding<sup>23,24</sup> and complications such as hysterectomy after operation, shock and death relating to postpartum hemorrhage.<sup>23-25</sup>

Even though difference in the rates of postpartum hemorrhage between the two groups were not statistically significant (1.67% in the control group and 0.00% in the test group), the difference in the volume of blood loss was statistically significant. New nursing care guideline was associated with lower volume of blood loss ( $16.67 \pm 36.98$  mL) compared with that in the usual nursing care ( $23.33 \pm 180.74$  mL) ( $P$ -value < 0.001). This could be concluded that this newly developed nursing guideline offered better partial clinical benefit by reducing volume of blood loss after Cesarean section. This nursing guideline could be useful in various general hospitals should be subject to further investigation in a larger sample size of women with moderate to high risk of postpartum hemorrhage after Cesarean section.

## Acknowledgement

The authors would like to thank the director of Nopparat Ratchathani Hospital for research conduct permission, and mothers with post-Cesarean section for their participation in the study, and healthcare providers in the obstetric and gynecology ward for research facilitation. We also would like to extend our great gratitude to the experts for providing recommendations for research tool revision.

## References

1. Liabsuetrakul T, Sukmanee J, Thungthong J, Lumbiganon P. Trend of Cesarean section rates and correlations with adverse maternal and neonatal outcomes: A secondary analysis of Thai Universal Coverage Scheme data. *Am J Perinatol Rep* 2019;9(4):e328–e336.
2. Say L, Chou D, Gemmill A, et al. Global causes of maternal death: a WHO systematic analysis. *Lancet Global Health* 2014; 2(6):e323-333.
3. World Health Organization. WHO recommendations for the prevention and treatment of postpartum haemorrhage. Italy. World Health Organization, 2012. (Accessed on Jan. 15, 2019, at [https://www.who.int/reproductivehealth/publications/maternal\\_perinatal\\_health/9789241548502/en/](https://www.who.int/reproductivehealth/publications/maternal_perinatal_health/9789241548502/en/))
4. Lim PS. Uterine atony: Management strategies. In: Kochhar P (ed.). *Blood transfusion in clinical practice*. India. IntechOpen, 2012: pp.97-128.
5. Carroll M, Daly D, Begley CM. The prevalence of women's emotional and physical health problems following a postpartum haemorrhage: a systematic review. *BMC Pregnancy Childbirth* 2016;16:261. (doi: 10.1186/s12884-016-1054-1)
6. Chairat S. Nursing role: Saving mothers from massive management in postpartum hemorrhage. Bangkok. Union Creation, 2017. (in Thai)
7. Obstetric and Gynecological Ward, Nopparat Ratchathani Hospital. Annual maternity statistics, 2015 - 2017. Bangkok. Nopparat Ratchathani Hospital, 2017. (in Thai)
8. Suta J, Leungratsameerung S, Phaloprakarn C. A risk score for predicting postpartum hemorrhage in association with Cesarean delivery. *Thai J Obstet Gynaecol* 2015;23(1):3-11.
9. Suyawej R, Keesakul C, Ittichaikulthol W, Sonkhammee P. Factors affecting postpartum hemorrhage during Caesarean section. *Thai J Anesthesiol* 2015;41(2):53-63. (in Thai)
10. Briley A, Seed PT, Tydeman G, et al. Reporting errors, incidence and risk factors for postpartum haemorrhage and progression to severe PPH: a prospective observational study. *Br J Obstet Gynecol* 2014; 121(7):876-888.
11. Plodrit L, Vipavakarn S, Kinglek A. Development of clinical nursing practice guidelines to prevent early postpartum hemorrhage in labor room, Krabi Hospital. *Southern Coll Net J Nurs Pub Health* 2016; 3(3):127-141. (in Thai)



12. Kangwantrakul P, Inyasri O. Development of nursing practice guidelines for the prevention of postpartum hemorrhage in the first two hours after giving birth at labor room, Udonthani Hospital. *J Boromarajonani Coll Nurs* 2017;33(2):121-134. (in Thai)
13. Maneechan N, Jamnam U. Effectiveness of implementing clinical nursing practice guidelines for prevention of early postpartum hemorrhage at Ratchaburi Hospital. *Reg 11 Med J* 2018;31(1):143-155. (in Thai)
14. Brown GT, Rodger S. Research utilization models: Frameworks for implementing evidence-based occupational therapy practice. *Occup Ther Int* 1999;6(1):1-23.
15. Collier C, Stinson M. Mississippi Perinatal Quality Collaborative: Obstetric hemorrhage initiative toolkit, A collaborative quality improvement initiative with the alliance for innovation in maternal health (1<sup>st</sup> ed). Mississippi. Mississippi Perinatal Quality Collaborative, 2016: pp.1-68.
16. Cheng W, Wang Q, Zhang Z. Application effect of sterile normal saline ice for post-partum hemorrhage at the time of cesarean delivery: A retrospective review. *J Obstet Gynaecol Res* 2016;42(10):1286-1289.
17. Collier C, Stinson M. Mississippi Perinatal Quality Collaborative: Obstetric hemorrhage initiative toolkit 2016. November, 2016. (Accessed on Jan. 15, 2019, at <https://mspqc.org/wp-content/uploads/2017/02/MSPQC-Obstetric-Hemorrhage-Toolkit.pdf>)
18. Chang CC, Wang TI, Chen YH, Lin HC. Anesthetic management as a risk factor for postpartum hemorrhage after cesarean deliveries. *Am J Obstet Gynecol* 2011;205(5):462:e1-7. (doi: 10.1016/j.ajog.2011.06.068)
19. Mattson S, Smith JE. Postpartum complication, 4<sup>th</sup> ed. USA. Saunders Elsevier, 2011.
20. Bates GW, Shomento S. Adhesion prevention in patients with multiple cesarean deliveries. *Am J Obstet Gynecol* 2011;205(6 suppl):S19-S24.
21. Blomberg M. Maternal obesity and risk of postpartum hemorrhage. *Obstet Gynecol* 2011;118(3):561-568.
22. Sebire NJ, Jolly M, Harris JP, et al. Maternal obesity and pregnancy outcome: a study of 287,213 pregnancies in London. *Inter J Obesity* 2001;25:1175–1182.
23. Bandidpanicha P, Ponsane N, Luangkwan S. The development of nursing care system for prevention postpartum hemorrhage. *Med J Sisaket Surin Buriram Hosp* 2017;32(2):131-44. (in Thai)
24. Charoensri P, Sarakarn W, Chaiyara B. The development of a nursing model for pregnant women to prevent early postpartum hemorrhage. *J Nurs Health Care* 2017;35(3):48-57. (in Thai)
25. Okafor II. Effectiveness of non-pneumatic anti-shock garment (NASG) in preventing shock-related morbidity and mortality in severe hemorrhagic shock. *Crit Care Obstet Gynecol* 2017;35(3):1-7.