Clinical Audit of Postpartum Hemorrhage at District-Level and Referral-Level Hospitals in Southern Thailand

Pattarawalai Talungchit MD*,
Tippawan Liabsuetrakul MD, PhD**

** Department of Obstetrics and Gynecology, Faculty of Medicine, Siriraj Hospital, Mahidol University, Bangkok, Thailand*
*** Epidemiology unit, Faculty of Medicine, Prince of Songkla University, Hat Yai, Songkhla, Thailand*

Objective: *Assess the management and clinical outcomes of women diagnosed immediate PPH in three referral hospitals and six district hospitals in southern Thailand.*
Material and Method: *A cross-sectional study was done in participated hospital. Medical records of eligible cases were reviewed for management using evidence-based checklist. The adherence to each item of managements and the association between the management and related morbidities were analyzed.*
Results: *Medical records of 360 cases were assessed. Low adherence of retaining Foley catheter (44%) and close hemodynamic monitoring (67%) was found at district level. Retaining Foley catheter was demonstrated at referral level in 76% but performing uterine massage was documented in 67%. The adherence of managements was more likely to be found in cases with severe blood loss or received blood transfusion.*
Conclusion: *Although low incidence of PPH was reported, incidence of blood transfusion, hypovolemic shock, and hysterectomy were not uncommon. Suboptimal care for hemodynamic monitoring and incomplete documentation of treatment need to be improved.*

Keywords: *Clinical audit, Postpartum hemorrhage, Quality of care, Management*

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Postpartum hemorrhage (PPH) is a leading cause of severe maternal morbidity and mortality, especially in developing countries[1]. A systematic review on epidemiology of PPH showed the overall prevalence of PPH in 6% with a variation across regions. This variation was due to different diagnostic criteria, study settings, study designs, sample size, obstetric characteristics of study samples, and the managements and outcome measurements[2]. Accurately practical measurement of blood loss during and after delivery is still debatable. The visual estimation of blood loss, which is the most common method used, usually lead to underestimated blood loss and subsequently underreporting incidence of PPH[3].

Although the best-practice recommendation for PPH has been established[4], the implementation and adoption of this practice remain a challenge[5]. Substandard care of immediate PPH attributed to severe maternal mortality and morbidity has been documented globally, particularly in developing countries[6-8]. As a result, the improvement of quality of care is important and urgent. Process of care is one of three components indicating quality of care[9], which can be evaluated by clinical audit.

Criterion-based clinical audit is an audit of clinical managements using the criteria proven by the providers[10]. Although the benefit of audit in obstetric practice was inconclusive[11-13], the criterion-based clinical audit for PPH recently showed an increase of adherence to the recommended guideline, and a reduction of severe PPH, maternal mortality and maternal morbidity[8,14,15]. A previous study using a criterion-based audit in obstetric morbidities at referral hospitals in southern Thailand revealed a relative substandard care for women complicated with PPH; however, this audit was not conducted at a district-level hospital[7]. The present study thus aimed to assess the management and related morbidities in women diagnosed immediate PPH at district- and referral-level hospitals using the evidence-based guidelines.

Correspondence to:
Talungchit P, Epidemiology Unit, Faculty of Medicine, Prince of Songkla University, Hat Yai, Songkhla 90112, Thailand.
Phone: 074-451-165, Fax: 074-429-754
E-mail: siriraj105@yahoo.com

Material and Method

Study setting

A cross-sectional study was conducted at six district hospitals and three referral hospitals, including

one provincial, one regional, and one university hospital, in Songkhla province in the South of Thailand. University and regional hospitals were a tertiary referral center, which has a multidisciplinary team, specialists, subspecialists, and well-functioning equipment. Provincial hospitals have obstetricians, nurses, and midwives; however, number of specialists and equipment is relatively limited. Considering the sufficient number of women diagnosed PPH at district hospitals, 6 of 16 district hospitals in Songkhla province which has 30 to 50 deliveries per month, were selected. Of the six district hospitals selected, the general practitioner was the doctor responsible for looking after the pregnant and delivered women, except in two district hospitals, there was one obstetrician working at each hospital. In general, cesarean section was not performed at district-level hospital; however, it was done in one district hospital where the facilities were equipped and it was operated by an obstetrician or a surgeon.

Ethical consideration

The present study was approved by the Institute Ethics Committee of the Faculty of Medicine, Prince of Songkla University (EC 53-108-18-1-3 and EC 52-340-18-5-3) and the Ethical Review Committee for Research in Human Subjects, Ministry of Public Health, Thailand (Ref. no. 16/2553).

Data collection process

Medical records of women diagnosed with immediate PPH at selected hospitals between October 2008 and September 2009 were reviewed by a trained research team. The diagnosis of PPH was verified using a definition of estimated blood loss at least 500 and 1,000 ml within 24 hours after delivery for vaginal and caesarean delivery, respectively[16]. Medical record reviews were performed by a principle investigator and a trained research assistant using pre-established data abstraction form comprising two sections: obstetric characteristics and information of case diagnosis and managements. Obstetric characteristics were maternal age, parity, medical and obstetrical history, gestational age at delivery, mode of delivery, hospital transfer and fetal birth weight and Apgar scores. The information of PPH diagnosis, identified causes of PPH, and their general and specific managements were assessed. The items of general and specific managements used were developed from evidence-based knowledge and best-practice guideline incorporated with the expert consensus approved by leader opinion[17]. The morbidities of interest were hypovolemic shock, blood transfusion, and hysterectomy.

Analysis

The data were double entered in EpiData 3.1 (freeware distributed by the EpiData Association, Odense, Denmark, available for download at the website http://www.epidata.dk) and analyzed using R 2.10.0 Software (freeware distributed by the R Development Core Team, available for download at the website http://cran.at.r-project.org). The continuous and categorical data by referral hospital (three referral hospitals) and district hospital (six district hospitals) were described in terms of a median with interquartile range and a percentage, respectively. The association between the adherence of managements and severity of PPH classifying as the occurrence of hypovolemic shock, blood transfusion, severe blood loss, or referral status were analyzed by univariate and multivariate analyses. The obstetric characteristics and managements associated with the prevalence of morbidities of interest were analyzed using multivariate analysis. The statistical significance was considered as a p-value of less than 0.05.

Results

During the one-year study period, the total deliveries were 4,216 at six district hospitals and 12,117 at three referral hospitals, of which the immediate PPH was diagnosed in 141 (3.34%) and 238 (2%), respectively. No maternal mortality was reported in this period. Of 379 reported cases, 360 medical records, including 132 in district and 228 in referral hospitals, were evaluated after the diagnosis according to the definition of blood loss was reviewed and reassured.

Table 1 describes the obstetric characteristics of women diagnosed PPH at each hospital level. Median age of cases in the referral hospital was significantly higher than that in district hospitals ($p = 0.02$); however, the distribution of women in teen or advanced age was not significantly different. No difference of parity, multiple pregnancies and fetal macrosomia was shown. Lower gestational age at delivery and higher rate of cesarean section were significantly found in the referral hospitals.

The managements according to the causes of immediate PPH in the district hospital are demonstrated in Table 2. For district hospitals, major causes of PPH were uterine atony (79%), retained placenta (16%) and

Table 1. Obstetric characteristics of women with immediate PPH

	District hospital n = 132, n (%)	Referral hospital n = 228, n (%)	p-value*
Maternal age (median, IQR)	28 (24, 34)	31 (25, 36)	0.020
Age group (years)			0.360
< 20	10 (7.6)	13 (5.7)	
20-34	92 (70.2)	150 (65.8)	
> 35	29 (22.1)	65 (28.5)	
Gestational age at delivery			0.002
< 34 weeks	4 (3.1)	13 (5.7)	
34- < 37 weeks	5 (3.8)	34 (15.0)	
> 37 weeks	122 (93.1)	180 (79.3)	
Parity			0.587
Nulliparous	36 (27.3)	74 (32.5)	
Multiparous	90 (68.2)	144 (63.2)	
Grandmultiparous	6 (4.5)	10 (4.4)	
Fetal macrosomia			1.000
Birth weight > 4,000 g	6 (4.5)	9 (4)	
Route of delivery			0.003
Normal labor	92 (69.7)	123 (53.9)	
Cesarean section	25 (18.9)	82 (36.0)	
Operative delivery	15 (11.4)	23 (10.1)	

* Chi-square test for categorical variables and Wilcoxon ranksum test for continuous variables

combination of retained placenta and uterine atony (5%) of which the median amount of estimated blood loss was similar (p-value = 0.85 by Kruskal-Wallis test). Only one case had a massive PPH due to a tear of birth passage. Intravenous fluid administration was given for all cases. Foley catheter was retained in less than half of cases based on the documents in the medical records; however, this practice was more likely to be reported in cases with estimated blood loss greater than 1,000 ml (adjusted OR 7.7; 95% CI 3.14, 18.87). Close monitoring of vital sign and urine output was found in the two-thirds of cases which were more common in cases receiving blood transfusion (adjusted OR 3.85; 95% CI 1.42, 10.4) and estimated blood loss greater than 1,000 ml (adjusted OR 4.89; 95% CI 1.71, 13.99). For specific managements based on causes of PPH, uterine massage and uterotonic drugs were given in the cases diagnosed uterine atony more than 90%. Of 27 cases with retained placenta, 19 cases were treated by manual removal of placenta of which the procedure was performed successfully without refer in 17 cases. Uterine massage and uterotonic drugs were given for all cases after placenta removal without association with severe blood loss, shock, blood transfusion, or transfer.

Table 3 presents the managements according to the causes of immediate PPH in referral hospital. The causes of PPH were uterine atony alone (68%), retained placenta (16%), combination of retained placenta and PPH (8%), tear of birth passage (3%), abnormal placentation (3%), and coagulation defect (2%). Intravenous fluid administration was given for all cases and Foley catheter was retained in third-fourths of cases. Higher likelihood of retaining Foley catheter was found in cases who received blood transfusion (adjusted OR 2.56; 95% CI 1.22, 5.35) or their estimated blood loss greater than 1,000 ml (adjusted OR 10.25; 95% CI 3.41, 30.81). Vital sign monitoring was also four times higher in cases who received blood transfusion (adjusted OR 4.25; 95% CI 1.48, 12.24). All specific treatments for each cause were well documented (> 90%), except uterine massage, which available records were incomplete, especially in cases undergoing cesarean section.

Twenty-two cases with uterine atony failed to medical treatment and had surgical interventions

Table 2. Managements of postpartum hemorrhage at district hospitals and maternal morbidity

General management		Hypovolemic shock	Blood transfusion	Severe blood loss[a]	Refer
	n = 132	n = 20, n (%)	n = 36, n (%)	n = 36, n (%)	n = 19, n (%)
Retained Foley catheter	58 (44.0)	10 (50.0)	19 (52.8)	28 (77.8)*	11 (57.9)
Intravenous fluid administration	130 (98.5)	20 (100.0)	36 (100.0)	36 (100.0)	19 (100.0)
Vital sign monitoring[b]	88 (66.7)	16 (80.0)	30 (83.3)*	31 (86.1)*	11 (57.9)
Specific management		Hypovolemic shock	Blood transfusion	Severe blood loss[a]	Refer
Uterine atony	n = 104	n = 11, n (%)	n = 27, n (%)	n = 29, n (%)	n = 8, n (%)
Uterine massage	103 (99.0)	10 (90.9)	27 (100.0)	28 (96.6)	8/8
Uterotonic drug given	101 (97.0)	10 (90.9)	27 (100.0)	29 (100.0)	8/8
Retained placenta without uterine atony	n = 21	n = 8, n (%)	n = 5, n (%)	n = 6, n (%)	n = 10, n (%)
Placenta removal	13 (62.0)	6/8	5/5	4/6	2/5
Successful removal	n = 11	n = 5, n (%)	n = 5, n (%)	n = 2, n (%)	n = 0, n (%)
Uterine massage and uterotonic drug given after placenta removal	11 (100.0)	3/5	4/5	1/2	0
Retained placenta with uterine atony	n = 6	n = 1, n (%)	n = 3, n (%)	n = 1 n (%)	n = 1, n (%)
Placenta removal	6/6	1/1	3/3	1/1	1/1
Uterine massage and uterotonic drug given after removal of placenta	6/6	1/1	3/3	1/1	1/1
Tear birth passage	n = 1	n = 0, n (%)	n = 1, n (%)	n = 0, n (%)	n = 0, n (%)
Repair birth passage	1/1	0	1/1	0	0

Management which significantly associated (multivariate regression analysis) with any maternal morbidity was remarked as "*"

[a] Vital sign monitoring is referred to pulse and blood pressure be recorded at least every 15 minutes for 2 hours, and urine output be measured hourly

[b] Estimated blood loss > 1,000 ml

performed (two vessel ligations alone, three B-Lynch sutures alone, one B-Lynch suture and hysterectomy and 16 immediate hysterectomies). Surgical interventions were significantly performed for cases with estimated blood loss greater than 1,000 ml or received blood transfusion. For other uncommon causes, seven pregnancies were diagnosed as abnormal placentation. Six of them were delivered by cesarean section due to placenta previa and/or previous cesarean section and all of them underwent peripartum hysterectomies. PPH from coagulopathy was detected in five cases due to severe preeclampsia, placenta abruption, and disseminated intravascular coagulopathy.

The association between outcomes of interest (blood transfusion and hypovolemic shock) and obstetric characteristics and the managements are shown in Table 4. A higher rate of severe blood loss but a lower rate of hypovolemic shock was detected in cesarean section than that in vaginal delivery. Retained placenta with uterine atony and uncommon causes of PPH including tear of birth passage, abnormal placentation, and coagulopathy were significantly associated with blood transfusion compared to uterine atony alone. Two times higher rate of blood transfusion was found in cases diagnosed in referral hospitals than that in district hospital. Cases referred from district to referral hospitals were less likely to receive blood transfusion before or during transfer.

Discussion

Although a lower incidence of immediate PPH was reported, the simultaneous evidence of hypovolemic

Table 3. Managements of postpartum hemorrhage at referral hospitals and maternal morbidity

General managements		Hypovolemic shock	Blood transfusion	Severe blood loss[a]	Refer
	n = 228	n = 26, n (%)	n = 131, n (%)	n = 98, n (%)	n = 67, n (%)
Retained Foley catheter	173 (75.9)	22 (84.6)	116 (88.5)*	94 (95.9)*	57 (85.1)
Intravenous fluid administration	228 (100.0)	26 (100.0)	131 (100.0)	98 (100.0)	67 (100.0)
Vital sign monitoring[b]	209 (91.7)	23 (88.5)	126 (96.2)*	95 (96.9)	60 (89.6)
Cross matching	207 (90.8)	26 (100.0)	131 (100.0)	97 (99.0)	63 (94.0)
Specific managements		Hypovolemic shock	Blood transfusion	Severe blood loss[a]	Refer
Uterine atony	n = 155	n = 17, n (%)	n = 84, n (%)	n = 66, n (%)	n = 43, n (%)
Uterine massage	103 (67.0)	13 (76.5)	54 (64.3)	36 (54.6)*	26 (60.5)
Uterotonic drug given	152 (98.0)	17 (100.0)	81 (96.4)	65 (98.5)	42 (97.7)
Surgical intervention	22 (14.0)	4/17	20 (23.8)*	19 (28.79)*	4/43
Retained placenta	n = 37	n = 5, n (%)	n = 18, n (%)	n = 7, n (%)	n = 6, n (%)
Placenta removal	36 (97.0)	5/5	18 (100.0)	7/7	6/6
Uterine massage and uterotonic drug given after placenta removal	37 (100.0)	5/5	18 (100.0)	7/7	6/6
Retained placenta with uterine atony	n = 17	n = 2, n (%)	n = 12, n (%)	n = 10, n (%)	n = 6, n (%)
Manual removal of placenta	17 (100.0)	2/2	12 (100.0)	10 (100.0)	6/6
Uterine massage and uterotonic drug given after removal of placenta	17 (100.0)	2/2	12 (100.0)	10 (100.0)	6/6
Others[c]	n = 19, n (%)	n = 2, n (%)	n = 17, n (%)	n = 15, n (%)	n = 3, n (%)
Surgical intervention	8/19	0 (0)	8/17	8 (15.0)	3/3

Management which significantly associated (multivariate regression analysis) with any maternal morbidity was remarked as "*"

[a] Vital sign monitoring is referred to pulse and blood pressure be recorded at least every 15 minutes for 2 hours, and urine output be measured hourly

[b] Estimated blood loss greater than 1,000 ml

[c] Other uncommon causes of PPH: abnormal placentation, tear birth passage and coagulopathy

shock, blood transfusion, and peripartum hysterectomy was common. Suboptimal care for hemodynamic monitoring and incomplete documentation of treatment was demonstrated. The adherence to management criteria was more common in severe cases.

The incidence of immediate PPH in the present study was similar to a previous study in Southern Thailand, it was lower than the global incidence reported[2,7]. This different reported incidence might be explained by various techniques of blood loss estimation during delivery until immediate 24 hours of postpartum, different criteria to identify PPH cases and reporting system[2]. Previous studies on adverse consequences of immediate PPH showed the incidence of peripartum hysterectomy ranging from 0.35 to 0.83 per 1,000 deliveries[18,19], hypovolemic shock about 9.9%[20] and blood transfusion from 1.9 to 11.7% of PPH cases[21]. As the result, the incidence of these consequences in the present study was higher than previous studies since peripartum hysterectomy is the most common surgical intervention for severe PPH[18] and high coincidence of anemia in pregnancy in the authors' setting[22].

Peripartum hysterectomy is a surgical procedure commonly indicated by uncontrollable bleeding from uterine atony and abnormal placentation[18]. Other

Table 4. Factors associated with maternal morbidities

Factors	Hypovolemic shock adj. OR (95% CI)	p (LR-test)	Blood transfusion adj. OR (95% CI)	p (LR-test)
Maternal age (Ref: 20-34 years)[a]		0.002		
≥ 35	1.91 (0.97, 3.77)			
Route of delivery (Ref: normal delivery)		<0.001		0.02
Cesarean section	0.12 (0.03, 0.39)		0.43 (0.23, 0.81)	
Operative delivery	0.89 (0.34, 2.33)		1.28 (0.59, 2.78)	
Hospital level (Ref: district level)				0.007
Referral hospital			2.09 (1.21, 3.59)	
Causes of PPH (Ref: uterine atony)				0.05
Retained placenta			1.39 (0.72, 2.68)	
Others[b]			5.43 (1.1, 26.44)	
Retained placenta with uterine atony			2.09 (0.77, 5.70)	
Estimated blood loss (Ref: 1,000 ml or less)				<0.001
1,001-2,000 ml			2.88 (1.71, 4.85)	
> 2,000 ml			7.22 (2.40, 21.56)	
Referral status (Ref: no transfer)				0.03
Receiving from district hospital[c]			1.55 (0.80, 3.02)	
Refer to referral hospital[d]			0.21 (0.05, 0.92)	

Adjusting for age, parity, hospital level, referral status, causes of PPH, estimated blood loss and route of delivery in the first model

[a] No cases with hypovolemic shock in age group < 20 years

[b] Other uncommon causes of PPH defined as abnormal placentation, tear birth passage and coagulopathy

[c] Cases at referral hospitals which were referred from other hospitals

[d] Cases at district hospitals which were referred to referral hospitals

interventions to preserve fertility such as vessel ligation, B-Lynch suture or arterial embolization were limited due to inadequate training and skills. The association between cesarean section and peripartum hysterectomy was supported by a study that showed a strong relationship of abnormal placentation and uterine atony with cesarean delivery[18]. Although the hemoglobin level is commonly used for an indicator of blood transfusion[23], the variation of providing blood transfusion among clinicians was reported depending on amount of postpartum blood loss, causes of PPH, hospital level and referral status. High rate of blood transfusion in the present study may be due to the provider's perception of severity of PPH. A lack of consensus on a guideline for blood transfusion might be associated with unnecessary transfusion. Compared with vaginal delivery, a higher amount of estimated blood loss but lower rate of hypovolemic shock was found in cesarean section. This might be explained by available intensive monitoring, good equipment, and prompt resuscitation during the operation[24].

A reduction of adverse consequences due to PPH is possible if prompt diagnosis and treatment using proper management is given[15]. Clinical audit is one of the assessments and improvement tools for quality of care that has been increasingly used in obstetric care in developing countries[13]. Two studies in Malawi confirmed the benefit of clinical audit on increasing adherence to standard management of postpartum hemorrhage as well as severe maternal morbidity and mortality[8,15]. Suboptimal care for close hemodynamic monitoring in PPH cases similar to the present study was previously reported but the improvement of practice after an audit was still controversial[6,8]. Shortage of providers was the most common reason from health providers with respect to this suboptimal care. Although the close monitoring was prioritized in PPH cases with severe blood loss or received blood transfusions, the issue of limited human resource is needed to be solved since cases with PPH are vulnerable and hemodynamic monitoring is crucial[25].

There were several limitations in the present study. First, the medical record review was used for assessing clinical managements and outcomes in this clinical audit. Missing of proper management in medical records might be due to either "not performed" or "performed but not recorded". Therefore, the completeness of medical records is critical for clinical audit[7,10]. Second, this was a cross-sectional study so the causal relationship between management of PPH and adverse consequences could not be identified. Lastly, even although validity and reliability of checklist criteria was evaluated[17] the reliability of the audit was not tested.

Clinical audit is a tool for assessing and monitoring the clinical practice, which is an important process to improve the quality of care[10]. Baseline information of this clinical audit was useful for a feedback to the providers and this would encourage them to improve their clinical managements. Regular clinical audit is essential for continuous quality improvement and beneficial for completeness of documentation[8]. Effectiveness of clinical audit on quality of case managements and consequences of severe maternal morbidity and mortality needs to be further studied.

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Potential conflicts of interest

None.

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การวัดคุณภาพการดูแลรักษาและการเจ็บป่วยรุนแรงในสตรีที่มีภาวะตกเลือดหลังคลอด

ภัทรวลัย ตลึงจิตร, ทิพวรรณ เลียบสื่อตระกูล

วัตถุประสงค์: *เพื่อวัดคุณภาพการดูแลรักษาและการเจ็บป่วยรุนแรงของสตรีที่มีภาวะตกเลือดหลังคลอดในโรงพยาบาลรับส่งต่อสามแห่ง และโรงพยาบาลชุมชนหกแห่งในจังหวัดสงขลา*

วัสดุและวิธีการ: *การศึกษานี้เป็นการศึกษาแบบตัดขวางโดยใช้การตรวจดูบันทึกในเวชระเบียนของสตรีหลังคลอดที่มีภาวะดังกล่าวเทียบกับเกณฑ์การดูแลรักษาซึ่งสร้างขึ้นจากหลักฐานเชิงประจักษ์ ข้อมูลที่ได้ถูกนำมาวิเคราะห์เพื่อหาสัดส่วนการรักษาที่เป็นไปตามเกณฑ์และความสัมพันธ์ของการดูแลรักษากับการเจ็บป่วยจากการตกเลือดหลังคลอด*

ผลการศึกษา: *จากเวชระเบียนของสตรีที่มีภาวะตกเลือดหลังคลอดทั้งหมดจำนวน 360 ราย พบว่าการดูแลรักษาในโรงพยาบาลชุมชนที่น้อยกว่าเกณฑ์ ได้แก่ โดยการใส่สายสวนปัสสาวะ (ร้อยละ 44) และการตรวจติดตามอาการแสดงทางระบบการไหลเวียนเลือดอย่างใกล้ชิด (ร้อยละ 67) สำหรับโรงพยาบาลรับส่งต่อพบการใส่สายสวนปัสสาวะร้อยละ 76 แต่การนวดคลึงมดลูกที่ปรากฏในบันทึกมีเพียงร้อยละ 67 อย่างไรก็ตามพบว่าการดูแลรักษาดังกล่าวทำบ่อยขึ้นในรายที่มีการเสียเลือดปริมาณมากหรือในรายที่ได้รับเลือด*

สรุป: *แม้ว่าผลการศึกษานี้พบอุบัติการณ์ของภาวะตกเลือดหลังคลอดต่ำ แต่ยังคงพบภาวะเจ็บป่วยรุนแรง ได้แก่ ภาวะช็อก การได้รับเลือด และการตัดมดลูกได้ การปรับปรุงการตรวจติดตามอาการแสดงทางระบบการไหลเวียนเลือดอย่างใกล้ชิดตลอดจนการบันทึกการรักษาให้ได้ครบถ้วนสมบูรณ์จึงยังเป็นสิ่งจำเป็น*