Original Article

Lower Uterine Segment Compression for 20 Minutes to Prevent Early Postpartum Hemorrhage

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Objective: Primary objective is to compare the incidence of early postpartum hemorrhage [PPH] between mothers who only received active management of third stage of labor [AMTSL] and mothers who receive both AMTSL and 20 minutes of lower uterine segment compression [LUSC] during the third stage of birth. Secondary objective is to compare the volume of blood loss between mothers who only received AMTSL and mothers who receive both AMTSL and 20 minutes of LUSC during the third stage of birth.

Materials and Methods: The randomized clinical control trial was performed in labor rooms of Sirindhorn Hospital between May and June of 2014. Subjects included 306 mothers with natural vaginal delivery. In control group, 153 mothers received only AMTSL. For treatment group, 153 mothers received AMTSL together with 20 minutes of LUSC after birth. Collect the blood lost through vagina until the suture was done and up to 2 hours after birth.

Results: One mother was excluded from the control group due to retained placenta. It was found that LUSC could reduce significantly the incidence rate of PPH from 10.5% (16 in 152) to 2.0% (3 in 153) with $p = 0.002$, and the blood loss in the treatment group was significantly lower than that of the control group (263.2±117.5 vs. 304.3±219.7, $p = 0.043$).

Conclusion: LUSC for 20 minutes can decrease the incidence of PPH by 81.3% and significantly lower the blood loss in the treatment group. It would be beneficial to prevent PPH and maternal death.

Keywords: Lower uterine segment compression, Postpartum hemorrhage, PPH prevention, PPH innovation, LUSC

J Med Assoc Thai 2018; 101 (9): 1151-6
Website: http://www.jmatonline.com

Postpartum hemorrhage [PPH] is a common condition, found in 2% to 11% of all births[1]. PPH, also contributes to 11% to 24% of maternal deaths[1-3]. In most cases, the cause of PPH is uterine atony. Nowadays, preventive procedures against PPH include active management of third stage of labor [AMTSL] which consist of uterotonic agents plus uterine massage, early/late cord clamping and controlled cord traction. Despite their successes in preventing PPH[4,5], there are still a number of mothers with PPH who need urgent medical attention. Delayed response to control the hemorrhage may result in various complications which include maternal death. Ten to twenty units of intravenous or intramuscular oxytocin prove effective against early PPH. If uterine contraction is still insufficient, 0.2 mg intravenous or intramuscular Ergometrine can then be used to induce a stronger and more frequent uterine contraction. However, due to its adverse effect of high blood pressure, it cannot be used in mothers who already have high blood pressure. In addition, Misoprostol can also be used. It is relatively cheap and versatile in its application, be it oral or suppository, but it also comes with more adverse effects such as shivering, vomiting and diarrhea[6,7].

At present, PPH remains a major problem in obstetric field. Despite a variety of preventive measures taken to avoid PPH, there is still 2% to 11% probability for it to occur, leading to detrimental complications such as those associated with blood transfusion, disseminated intravascular coagulopathy [DIC], or needed surgical intervention such as: vessel ligation, arterial embolization[8,9], B-lynch suture[10], or hysterectomy. These conditions contribute to a quarter of maternal deaths caused by PPH[6]. The present research aimed to prevent PPH, so that the associated complications could not occur. A literature review shown that mothers who underwent 10 minutes of

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How to cite this article: Anansakunwat W, Iamurairat W, Boonyoung P. Lower uterine segment compression for 20 minutes to prevent early postpartum hemorrhage. J Med Assoc Thai 2018;101:1151-6.

lower uterine segment compression [LUSC] had 56.5% decreased in the chances to develop PPH compared to the control group (2.9% vs. 6.8%)[11]. The study required the mothers from both group to undergo AMTSL immediately after birth, but the experimental group also received 10 minutes of LUSC.

LUSC is a maneuver which applies direct pressure onto the placental base which cannot achieve adequate contraction. The pressure allows uterine capillaries to clot and the bleeding will stop from the subsequent natural ligature. However, the normal clotting time can range from 8.5 to 15 minutes[12] or even up to 20 minutes[13] in some cases. Hence, in some patients, the pressure has to be applied longer than 10 minutes to cover the potential clotting time of 20 minutes. Twenty minutes of LUSC is a further research from the aforementioned one, increasing the compression time to 20 minutes. The procedure includes using one's hand to compress the lower uterine segment just above the pelvis for 20 minutes. The LUSC applies pressure on the ruptured small blood vessels end in the placental bed, causing the bleeding to immediately stop. The compression should last for 20 minutes, allowing enough time for coagulation factors to form a clot to block the ruptured vessels since the average clotting time is approximately 15 to 20 minutes.

Materials and Methods

The samples of 306 mothers were taken from labor room of Sirindhorn Hospital between May and June of 2014. This research utilized a randomized controlled trial. The criteria for subjects included mothers with 28 to 42 weeks pregnancy, natural vaginal birth, singleton without polyhydramnios, AFI value less than 20 cm via ultrasound measurement, mothers who did not receive magnesium sulfate and were healthy without significant dangerous condition such as heart disease, diabetes mellitus, epilepsy, thyrotoxicosis, or coagulation defects. The criteria ruled out mothers with uterine eversion, uteine rupture, retained placenta, birth canal hematoma, and mothers with coagulation abnormalities such as low platelets count or DIC. The experiment stopped if the subjects lost more than 2,000 ml of blood or if they had unstable vital signs.

Definition

Early PPH: Heavy bleeding with blood loss more than or equal to 500 ml during the first 24 hours after birth(14).

AMTSL[9]:

1. Giving 10 to 20 units of intravenous oxytocin in 1,000 ml solution or 10 units of intramuscular oxytocin within 1 minute after birth
2. Clamping umbilical cord within 3 minutes after birth
3. Placental delivery with controlled cord traction
4. Uterine massage after delivery of placenta

LUSC: The obstetrician using the tip of 4 fingers to compress at lower uterine segment as hard as he could as long as the patients did not feel uncomfortable pain in order to press the lower uterine walls against each other for at least 10 minutes[11].

Vaginal bleeding volume: The volume of blood lost through vagina within the first 2 hours after birth where 1 gram of blood is equal to 1 milliliter.

All participating patients received detailed explanation and were asked to sign informed consents. Randomization then took place when patients entered the second stage of labor by labor room nurses under the supervision of the obstetrician in charge.

Patients were divided into 2 groups by unrestricted randomization. Sample size was estimated using the following formula:

$$n = [Z_{\alpha/2}\sqrt{2pq} + Z_{\beta}\sqrt{p_1q_1 + p_2q_2}]^2 / (p_1 - p_2)^2$$

p_1 is the incidence of PPH in Sirindhorn Hospital (= 10%).

p_2 is the expected incidence of PPH after LUSC technique is applied (= 2%), the estimation of which derives from the report by Tamizian and Arulkumaran[1].

α and β were chosen to be 0.05 and 0.20, respectively. The calculated needed sample size is 153.

All statistic calculations were done by SPSS version 16 using student's t-test, Mann-Whitney U-test for quantitative data, or Chi-square test for qualitative data. Statistical significance is defined as $p<0.05$.

The control group for this experiment consists of mothers who had vaginal delivery and received AMTSL. The experimental group consists of mothers who had vaginal delivery and received AMTSL together with 20 minutes of LUSC after birth. A specially prepared plastic bag was placed to collect the blood lost through vagina until the suture was done and up to 2 hours after birth. The plastic bags containing blood would then be weighed using a standard scale with maximum weight of 3 kg. A 1 gram of blood is deemed equal to 1 milliliter of blood and the data were recorded.

LUSC can be performed with one hand, using all four fingers besides thumb to directly apply pressure onto the lower uterine segment, located just above the pubic symphysis. The pressure should be as

hard as possible as long as the patient does not experience discomforting pain. The LUSC can also be performed with both hands, which, in addition to the one hand technique, encompasses another hand to help apply pressure downward onto the uterine fundus (Figure 1, 2)[11]. The present study standardized the pressure application time at 20 minutes.

Results

There were 306 mothers in the present study, separated via randomization into 153 of control group and 153 of treatment group, 1 mother from control group was excluded due to retained placenta as shown in Figure 3.

In Table 1, the average ages, gestational age, parity, maternal body weight, height, and body mass index of mothers in control group and treatment group were no significant difference. The number of mothers with history of PPH in the control and treatment group was 3 people (2.0%) and 2 people (1.3%) respectively, shown no significant difference.

Antepartum and intrapartum variables: numbers of mother received oxytocin, hematocrit, duration of oxytocin drip, and duration in all stages of labor in control group were not significantly different from treatment group as shown in Table 2.

Comparison of intrapartum and postpartum characteristics as in Table 3 of both groups, there were no statistically significant difference in baby birth weight, numbers of mother required episiotomy, and perineal tear.

In Table 4, the average amount of blood loss during the third stage of labor was statistically significant different ($p = 0.045$) in control group than in treatment group. While in the fourth stage of labor, amount of blood loss was not different. It was found that LUSC could reduce significant incidence rate of PPH from 10.5% (16 in 152) to 2.0% (3 in 153) with $p = 0.002$, and the blood loss in the treatment group was significantly lower than that of control group (263.2±117.5 vs. 304.3±219.7, $p = 0.043$). The number of mothers who received methergin, nalador, cytotec, and blood transfusion in both groups were not significantly different.

Discussion

PPH is defined as blood loss of ≥500 ml in vaginal birth or ≥1,000 ml in cesarean section. Annually, there are 14 million mothers worldwide who experience pregnancy-associated hemorrhage, and 287,000 of which would not survive[15]. Of these deaths, 25%

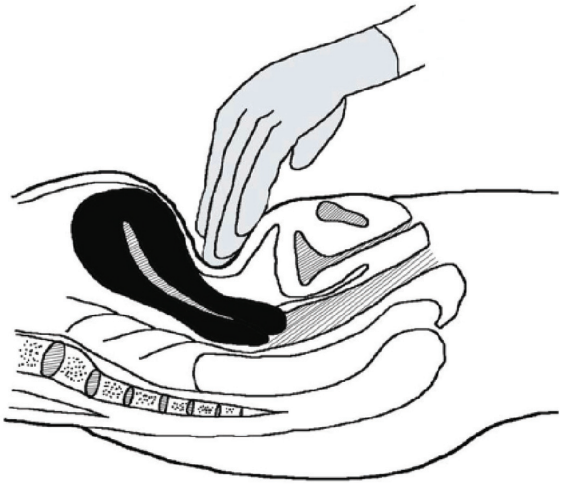

Figure 1. Lower uterine segment compression method in treatment of acute postpartum haemorrhage by compressing at the lower uterine segment only.

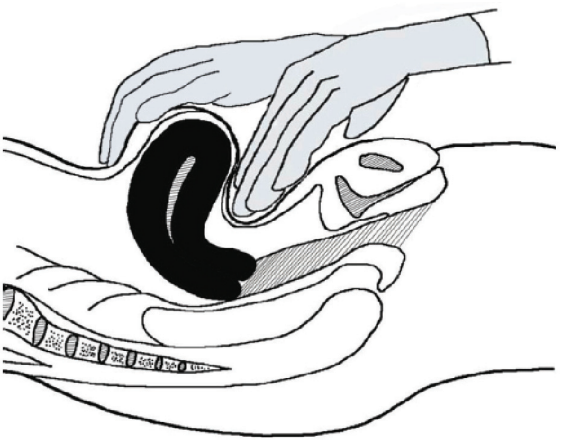

Figure 2. Lower uterine segment compression method in treatment of acute postpartum haemorrhage by compressing at the lower uterine segment with counteracting pressure from fundus.

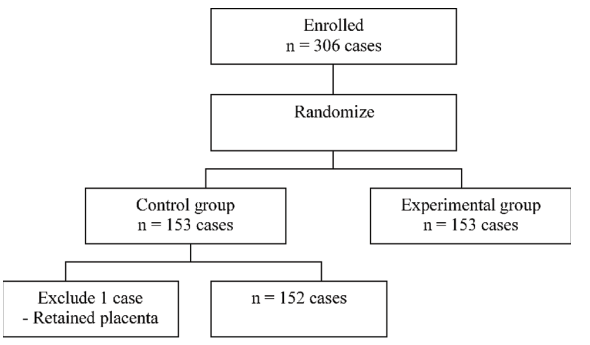

Figure 3. Flow chart of identification of trials.

Table 1. Baseline characteristics

Characteristic	Control group (n = 152)	Treatment group (n = 153)	*p*-value
Age (years), mean ± SD	26.3±6.0	26.4±6.1	0.89*
Gestational age (days), mean ± SD	272.5±11.3	272.8±11.1	0.83*
Parity, n (%)			0.20**
Nulliparous	46 (30.3)	57 (37.3)	
Multiparous	106 (69.7)	96 (62.7)	
Maternal body weight (kg), mean ± SD	68.0±11.8	67.2±11.7	0.55*
Height (cm), mean ± SD	158.6±5.8	158.0±5.7	0.38*
Body mass index, mean ± SD	27.1±4.5	26.9±4.3	0.74*
Previous PPH, n (%)	3 (2.0)	2 (1.3)	0.68***

PPH = postpartum haemorrhage

* *p*-value by student's t test, ** *p*-value by Chi-square test, *** *p*-value by Fisher's exact test

Table 2. Antepartum and intrapartum variables

Characteristic	Control group (n = 152)	Treatment group (n = 153)	*p*-value
Induction of labor, n (%)	16 (10.5)	26 (17.0)	0.10*
Hematocrit (vol%), mean ± SD	36.4±3.8	36.9±3.3	0.12**
Duration of oxytocin drip, median (min, max)	104.5 (20, 550)	102 (5, 437)	0.518***
Duration of labor (minutes), mean ± SD			
1st stage of labor	474.6±321.3	491.2±322.3	0.65**
2nd stage of labor	15.4±13.3	16.3±11.8	0.53**
3rd stage of labor	6.1±5.1	5.9±3.5	0.73**

* *p*-value by Chi-square test, ** *p*-value by student's t test, *** *p*-value by Mann-Whitney U test

Table 3. Comparing intrapartum and postpartum characteristics

Characteristic	Control group (n = 152)	Treatment group (n = 153)	*p*-value
Baby birth weight (g), mean ± SD	3,110.7±441.3	3,122.2±424.1	0.82*
Episiotomy, n (%)			0.19**
No	38 (25.0)	26 (17.0)	
Median	30 (19.7)	38 (24.8)	
Mediolateral	84 (55.3)	89 (58.2)	
Perineal tear, n (%)			0.22**
No	10 (6.6)	5 (3.3)	
1st degree	10 (6.6)	5 (3.3)	
2nd degree	126 (82.9)	139 (90.8)	
3rd to 4th degree	6 (3.9)	4 (2.6)	

* *p*-value by student's t test, ** *p*-value by Chi-square test

Table 4. Postpartum blood loss, treatment and medications

Characteristic	Control group (n = 152)	Treatment group (n = 153)	*p*-value
Amount of blood loss (ml), mean ± SD			
3rd stage	257.8±221.1	217.1±116.3	0.045*
4th stage	46.8±45.2	46.1±44.2	0.90*
Total blood loss	304.3±219.7	263.2±117.5	0.043*
PPH case, n (%)	16 (10.5)	3 (2.0)	0.002**
Methergin 0.2 mg, n (%)	3 (2.0)	2 (1.3)	0.68***
Prostaglandin (nalador), n (%)	1 (0.7)	0 (0.0)	0.49***
Cytotec, n (%)	1 (0.7)	1 (0.7)	1.00***
Blood transfusion, n (%)	3 (2.0)	0 (0.0)	0.12***

PPH = postpartum haemorrhage

* *p*-value by student's t test, ** *p*-value by Chi-square test, *** *p*-value by Fisher's exact test

is caused by PPH. The World Health Organization [WHO] aims to reduce maternal death by 75% in 2015 according to the Millennium Development Goal 5 [MDG5]. Starting in 1990, the goal is to decrease maternal mortality ratio [MMR] by 5.5% annually. However, a review conducted in 2010 revealed that the MMR had gone down by only 3.1% annually, which means the fall in MMR achieved only 47% of the original goal[16].

Besides, the inadequate improvement in dealing with hemorrhage, assessments also reveal the flaw in the current guideline on preventive measures against PPH. AMTSL involves uterotonic drugs such as oxytocin or ergometrine being used in conjunction with nondrug intervention. As it turned out, the effectiveness of preventive capability derived solely from uterotonic drugs and not at nondrug intervention[17] which consists of uterine massage, early/late cord clamping, and control cord traction. Hence, the prevention of PPH has to depend on uterotonic drugs, the usage of which is limited by the difficulty of storage and transport. This is because the drugs are heat labile and can

easily lose their effectiveness. Furthermore, skilled personnel are also required to administer the drugs. On the other hand, misoprotal is adequately heat resistant, easy to administer, be it oral or suppository, but its effectiveness is still controversial[18,19]. Therefore, aside from medication, there is still no a tool or measure that can truly prevent PPH. From a literature review, it is found that 10 minutes of LUSC could effectively reduce PPH by 56.5%[11].

In the present study, the technique is still LUSC but the duration increased to 20 minutes in order to cover the clotting time of 15 to 20 minutes[13]. The principle of LUSC is to compress lower uterine segment which is not properly contracting by applying direct pressure to the placenta bed. The bleeding would stop immediately and after 10 to 20 minutes a clot would form and the bleeding would cease permanently. The decrease in uterine bleeding prevents uterine hypoxia, which could lead to uterine atony that ultimately causes PPH[20]. From the present study, it was found that LUSC could reduce the incidence rate of PPH from 10.5% to 2.0% (p = 0.002) and the blood loss in the treatment group was significantly lower than that of control group (263.2±117.5 vs. 304.3±219.7, p = 0.043). Comparing to the study conducted by Chantrapitak et al[11], utilized 10 minutes of LUSC, it was found that 20 minutes of LUSC yielded better results. The present study experienced some restriction in terms of time since 20 minutes of compression can be difficult to achieved in a busy labor room.

Conclusion

Twenty minutes of LUSC can decrease the incidence of PPH by 81.3%. This maneuver has high potential in decreasing worldwide maternal death that is caused by PPH. Since the procedure is done by hands, can be done anywhere and anytime, does not need much skills, does not cost anything, and does not have associated risk, it would be very beneficial for preventing PPH, especially in rural regions where resources are scarce or inaccessible.

What is already known on this topic?

From the literature review, only 2 papers presented about LUSC and the results of 10 minutes compression showed that PPH was reduced by 56%.

What this study adds?

This study also used LUSC to prevent PPH, but using longer compression of 20 minutes for better outcomes.

Potential conflicts of interest

The authors declare no conflict of interest.

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