Uterine Cooling During Cesarean Section an Attempt to Reduce Blood Loss and Atonic Post-Partum Hemorrhage

Original Article

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ABSTRACT

Objective: Evaluation of the effect of uterine cooling during caesarean section on both, amount of blood loss and incidence of uterine atony.

Method: This prospective randomized controlled study was conducted at Mansoura University Hospital, Obstetrics and Gynecology Department in the period from June 2017 to June 2018, included 220 patients who underwent delivery by caesarean section. All women included in the study were randomized into two equal groups; half of these patients were randomly assigned to uterine cooling after delivery of the fetus and placenta using cold saline. The other half of these patients, caesarean section was done in the usual manner. The amounts of blood loss were calculated for all patients during and after caesarean section. Also the occurrences of uterine atony were noticed on both groups. Data was regestrated for statistical analyses.

Results: There were no significant difference between both groups as regard of age, gravidity, parity, gestational age, no of previous caesarean section, preoperative hemoglobin level and hematocrit values . The total amounts of blood loss during and after caesarean section was significantly low in cooling group *P value* (<0.001). Although atonic postpartum hemorrhage was lower in cooling group (3 cases 2.7 %) versus (10 cases 9.1%) in non-cooling group, it was not statistically significant *P value* (0.53).

Conclusions: Uterine cooling by iced saline decrease total blood loss and decrease incidence of atonic PPH.

Key Words: Caesarean section, iced saline, uterine cooling.

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INTRODUCTION

PPH definition proposed by the American College of Obstetricians and Gynecologists (ACOG) states it is the "cumulative blood loss of ≥1000 mL or blood loss accompanied by signs and symptoms of hypovolemia within 24 hours following the birth process"[1]. The prevalence of PPH is believed to be around 6%, although this can vary somewhat by geographic region and delivery setting. Complications of PPH include anemia, disseminated intravascular coagulation, hysterectomy, and renal or liver failure[2]. The main causes of primary PPH, includes uterine atony, trauma to the genital tract, retained placental tissue and coagulopathy[3]. Uterine atony accounts for 75-90% of primary postpartum hemorrhage[4]. It occurs when inadequate myometrial tone results in unchecked blood flow to the placental bed[5]. The risk factors for atonic postpartum hemorrhage include: history of prior PPH, nulliparity, uterine overdistention (e.g. multiple gestations or polyhydramnios), placental abnormalities, such as placenta praevia or placenta accrete, coagulation abnormalities, anaemia, induction of labour, augmentation of labour, or use of an epidural and prolonged labour[2]. Delivery by cesarean section was associated with increased risk of PPH, especially when cesarean sections are performed when the cervical dilatation is more than 9 cm or in second stage of labor mainly due to avulsion of the blood vessels at the delivery of impacted presenting part[6]. Cesarean section also increases risk of uterine atony, a leading cause of PPH[7]. We can improve the outcomes from PPH by improved: prevention, and early treatment. Prevention includes antenatal strategies, active management of the third stage of labour. PPH treatment covers both medical and surgical treatment, and Supportive care, such as compression garments[8]. Routine use of uterotonic agents and manual measures (such as uterine massage) during caesarean section usually performed to initiate adequate uterine tone and reduce the risk of PPH. Despite of these UA may occur during Caesarean section[9]. The idea of cold therapy is that it can cause blood vessels within the smooth muscles to constrict, which subsequently decreases blood flow, so cooling the uterus by placing an icepack on the lower abdomen is one of non-pharmacological prophylactic strategies to prevent PPH; the reasoning is that cold compresses may help to

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contract the myometrium and decrease blood loss[10,11]. Iced saline was first used as a gastric lavage in gastro-duodenal hemorrhage in the 1960s. Recently, in a randomized controlled trial, uterine cooling during cesarean delivery proved to decreases blood loss and the incidence of PPH. The surgeon wrapped the uterus in icy laparotomy sponges during hysterotomy repair. The cooling time was short, but the effect was exceptional[12].

So this study aimed to use a new method (iced saline) to control blood loss and compared its efficacy with conventional methods (normal saline).

METHOD

Prospective randomized controlled study conducted at obstetrics and gynecology department, Mansoura University Hospital, Mansoura. The patients were recruited in the period from June 2017 to June 2018. Written informed consents were obtained from all subjects, proposal of this study was approved by Ethical Committee of Mansoura Faculty of Medicine, Egypt. Study group included 220 pregnant women who underwent a scheduled cesarean delivery or cesarean delivery after a trial of labor, admitted to obstetrics and gynecology department. Half the women were randomly assigned to uterine cooling and the other half were assigned to a control group. **First group:** 110 patients: the technique of cooling was applied to the uterus following delivery of the fetus and placenta and after exteriorization of the uterus. **Second group:** 110 patients: C-section was done in the usual manner using normal saline without cooling. We exclude: Patients with multiple pregnancy, polyhydramnios, medical disorder as PET and DM, antepartum hemorrhage, associated fibroids, coagulopathy, and CS done under general anesthesia. All patients subjected to; full obstetric history, general and local examination, US for assessment of fetus, placenta and amniotic fluid. Then calculation of gestational age by menstrual history and US. Lab analysis; liver, renal function, blood glucose level, CBC include HCT and HB and INR pre CS to exclude patients with coagulation profile.

Preoperative weighting of the sponges, drapes and towels. Preparation of iced 500cc. saline plastic bottles to be sterilized by antiseptics from outside then washed with sterile saline and opened in sterile container. The sterile sponges were immersed in this icy saline for the study group. The control group the sterile sponges immersed in 500cc saline at room temperature. Spinal anesthesia was used for all patients. During operation; the steps of cesarean section to be performed in the usual manner up to the point of uterine exteriorization after delivery of the fetus and placenta. In study group the whole uterus was wrapped in sponges immersed in the icy saline solution. In the control group the whole uterus was wrapped in sponges immersed in saline at room temperature. Repair of the uterine incision was made in the usual manner in both groups. Routine administration of pitocin immediately after placental delivery was done in both groups. Additional doses or other utero tonic agents were given when needed. Also blood or blood products were given when needed. Calculation of blood loss was done by combination of direct method and gravimetric method. The direct measurement was performed by collecting blood from a suction bottle using suction apparatus, the gravimetric method was used to estimate the amount of blood loss in the surgical towels. The surgical towels weighted before surgery and collected into a sterile metalic bowel which weighed empty before surgery. The bowel with collected towels was handled to the circulating nurse to weight it by highly accurate digital balance and then calculate the amount of blood loss. The following formula of total amount of blood loss in the soaked towels (in ml) = weight of the metallic bowel with the soaked towels (gm)-weight of the empty bowel +weight of towels before surgery (gm),the collected blood in the suction bottle added to calculated amount of blood in the towels. Blood in the pampers was calculated also by the same method. Operation time was calculated. Post-operative; medication taken to prevent atonic PPH: Oxytocin (Pitocin) :10-40 units per 500-1000ml solution continuous infusion or 10 units IM or Misoprostol (Cytotic) 600-1000 micrograms. Assessment blood loss. Laboratory analysis; CBC (HB and HCT)

Sample size was calculated by: https://www.dssresearch.com/KnowledgeCenter/toolkitcalculators/samplesiz ecalcul ators.aspx. according to expected difference in post-partum hemorrhage among cooling group compared to control group (9% vs 21%; $P < .02$) (Mitchell, Janice L. MD; Stecher, Jack MD; Crowson, James CRNA; Rich, Diana BSN, RNC-OB, CEFM - Obstetrics & Gynecology: May 2015) n=110 per group the cases was be assigned randomly to treatment groups by block randomization method. Alpha error =0.05 Power of study =80%. Blinding: double blinding for patients and investigators about type of treatment was adopted.

RESULTS

This study includes 220 subjects. They were divided into 2 groups according to saline temperature which was used during CS to compare the efficacy of temperature on blood loss during CS. As regard of the demographic criteria of the two groups (age, gravidity, parity, gestational age and number of previous CS) we do not have any significant difference between cooling and non-cooling group all of *P value* were more than 0.05. Also, we analyze variables which may affect amount of blood lose as AFI and INR. There was no significant difference between two groups in AFI with *P value* 0.085 as well as INR with *P value* 0.530. As regard of preoperative HB and HCT, there was no significant difference between two groups in HB level and HCT percentage with *p value* was 0.568 and 0.568, respectively; while post-CS HB level and HCT percentage were significantly high in cooling group when compared to non- cooling group, *p value* was (0.003 and 0.003) respectively. (Table 4) shows that; pre-CS there was no significant difference between two groups in towels weight and Pampers weight with *p value* was 0.064 and

0.607, respectively; while post-CS towels and pampers weight gained were significant low in cooling group when compared to non- cooling group *p value* was less than 0.001. Also, suction volume was significantly low in cooling group when compared to non-cooling group with *p value* less than 0.001. Total blood loss was significantly low in cooling group when compared to non- cooling group with *p value* <0.001 (Table 1).

As regard operation time, there was no statistically significance between two groups *p value* 0.290. (Table 5) shows that, only 3 cases (2.7%) in cooling group developed atonic PPH while non-cooling group 10 (9.1%) cases developed atonic PPH, although the number of cases of PPH was high in non cooling group, there was no statistically significant difference *p value* 0.53. In cooling group 2 cases (1.8%) developed sepsis and 1case (0.9%) developed sepsis in non cooling group; there was no statistically significant difference between two group according to post operative wound sepsis *p value* 0.7. (Table 6) shows that, in cooling group only 2(1.8%) was given medication and 1(0.9%) require compression sutures while in non-cooling group 4 (3.6%) was given medication, 3(2.7%) case require uterine artery ligation, 2(1.8%) require compression sutures, and 1(0.9%) case require internal iliac artery ligation. Using of surgical methods for treatment of atonic PPH was significantly higher in non-cooling group when compared to cooling group with *p value* 0.03.

Table 1: Demographic criteria of the studied groups

Maternal data	Coolinggroup (n=110)	Non coolinggroup (n=110)	Test of significance	*P-value*
Age / years Mean ± SD	29.08±5.06	29.20±5.03	t=0.173	0.863
< 30 y	56 (50.9%)	55 (50%)	c^2=0.018	0.893
≥ 30 y	54 (49.1%)	55 (50%)		
Gravidity Median (min-max)	2 (2-6)	2 (1-4)	Z=1.72	0.084
G < 3	59 (53.6%)	69 (62.7%)	c^2=1.86	0.172
G ≥ 3	51 (46.4%)	41 (37.3%)		
Parity Median (min-max)	1 (0-3)	1 (0-4)	Z=1.74	0.082
P0	3 (2.7%)	4 (3.6%)		
P 1-2	97 (88.2%)	100 (90.9%)	c^2=1.18	0.552
P ≥ 3	10 (9.1%)	6 (5.5%)		
gestational age	38.54±0.73	38.67±0.75	t=1.264	0.207
Previous CS				
No	7 (6.4%)	17 (15.5%)		
CS 1-2	93 (84.5%)	85 (77.3%)	c^2=4.74	0.093
CS 3-4	10 (9.1%)	8 (7.3%)		

Table 2: AFI and INR among the studied groups

Variables	Coolinggroup (n=110)	Non coolinggroup (n=110)	Student t-test	*P-value*
AFI	11.04±3.00	10.40±2.42	1.731	0.085
INR	1.02±0.03	1.01±0.03	0.629	0.530

Table 3: CBC among the studied groups

	Coolinggroup (n=110)	Non coolinggroup (n=110)	Student t-test	*P-value*
Hb pre	10.98±0.93	11.05±0.82	0.572	0.568
Hb post	10.38±1.09	9.96±0.94	3.033	0.003*
Paired t- test (*p value*)	18.12 (<0.001*)	42.63 (<0.001*)	-	-
HCT pre	32.96±2.81	33.16±2.48	0.572	0.568
HCT post	31.14±3.28	29.89±2.82	3.033	0.003*
Paired t- test (*p value*)	18.12 (<0.001*)	42.63 (<0.001*)	-	-

Table 4: Blood loss among the studied groups

	Coolinggroup (n=110)	Non coolinggroup (n=110)	Student t-test	*P-value*
Towels pre	92.73±3.00	92.05±2.39	1.86	0.064
Towels post	377.89±27.52	480.19±37.29	23.14	<0.001*
Paired t- test(*p value*)	110.13 (<0.001*)	109.26 (<0.001*)	-	-
Pambers pre	90.42±0.78	90.48±0.78	0.515	0.607
Pambers post	194.29±24.31	236.94±21.37	13.81	<0.001*
Paired t- test (*p value*)	45.26 (<0.001*)	72.35 (<0.001*)	-	-
Towels pre	92.73±3.00	92.05±2.39	1.86	0.064
Towels post	377.89±27.52	480.19±37.29	23.14	<0.001*
Paired t- test (*p value*)	110.13 (<0.001*)	109.26 (<0.001*)	-	-
Suction	299.40±33.61	576.57±42.55	53.60	<0.001*
Total blood loss	687.76±51.65	1112.3±62.45	54.94	<0.001*
Operation time	49.00±3.64	48.54±2.77	1.062	0.290

Table 5: Outcome

	Coolinggroup (n=110)	Non Coolinggroup (n=110)	Test of significant	*P-value*
Atonic PPH	3(2.7%)	10(9.1%)	c2=4.93	0.53
Sepsis	2(1.8%)	1(0.9%)	c2=4.01	0.7

Table 6: Treatment atonic PPH

	Coolinggroup (n=110)	Non Coolinggroup (n=110)	Test of significant	*P-value*
Medication	2(1.8%)	4 (3.6%)	c^2=5.93	0.03
Uterine artery ligation	0	3(2.7%)		
Compression sutures	1(0.9%)	2(1.8%)		
Internal iliac artery ligation	0	1(0.9%)		

DISCUSSION

Postpartum hemorrhage remains the leading direct cause of maternal deaths in low income countries[13]. Prevalence estimates for PPH represent 10% of all deliveries. Risk factors for PPH include advanced maternal age, nullipara, anemia, previous cesarean delivery, fibroid tumors, placenta previa or abruption, multiple gestation, polyhydramnios, amnionitis, hypertensive disorders of pregnancy, episiotomy, retained placenta, laceration of genital tract, uterine rupture, high neonatal weight and placenta accreta[14]. However, the ability to predict PPH from antepartum and intrapartum risk factors is very low[15]. Uterine atony is the one of commonest causes of PPH. According to ACOG, risk factors for atonic PPH includes uterine overdistintion secondary to hydramnose, multiple pregnancy, fetal macrosomia, high parity, rapid or prolonged labor, intraamniotic infection, and use of uterine relaxing agents. In spite of use uterotonic agents and manual measures (such as uterine massage) to initiate adequate uterine tone and reduce the risk of PPH during Caesarean delivery, refractory UA may occur requiring the use of second-line uterotonics (such as methylergonovine or carboprost) and other surgical or medical interventions (such as homeostatic brace suturing, interventional radiology, or hysterectomy)[16].

This study was aimed to use a new method iced normal saline for direct cooling of the uterus during CS to decrease blood loss and compared its efficacy with normal saline at room temperature. This study includes 220 patients were randomly divided into 2 equal groups according to saline temperature which was used during CS to compare the efficacy of temperature on blood loss during CS. Demographic data of the patients (age, gravidity, parity, gestational age and number of previous CS), do not have any significant difference between cooling and non-cooling group. Also, in our study we compare INR and AFI and we found that there was no significant difference between the two groups.

In our study there was significantly difference between the two groups as regard total blood loss which estimated by towels, pampers and suction apparatus the same result was obtained by Also by Mitchell *et al*., 2015, who reported that uterine cooling during cesarean section reduced total blood loss in the cooling group compared with the control group (536 vs. 756, respectively). In this study the surgeon wrapped the uterus in icy laparotomy sponges during

hysterotomy repair. The direct cooling time was short, but more effective than cooling of the lower abdomen[12]. Cheng, 2016 used ice blocks on the uterus after CS, to treat patients with PPH and reported that PPH can be treated successfully with peeled normal saline ice blocks. All patients recovered stably after surgery[17]. The author in this study used normal saline ice blocks for treatment of PPH not for prevention as in our study. Also, Nawasirodom *et al*., 2019; study the effect of uterine cooling in prevention of PPH during CS which include 160 patients they wrapped the uterus by sterile cooling swab after delivery of the fetus and reported that in uterine cooling group, in spite of there was a statistically significant reduction in intra-operative blood loss compared with routine CS and also the need for uterotonic drugs was significantly less in the uterine cooling group, but there was no significant difference between the two groups in postpartum hemorrhage[18].

On the other hand, our results do not go in hand with Masuzawa *et al*., 2017; who do cooling the lower abdomen after vaginal delivery. They reported that the effect of this method on reducing total blood loss is little. This result may be due to indirect cooling of the uterus through abdominal wall may not work as well as cooling the uterus directly, and the effect of applying the cold pack to the lower abdomen on the somatovisceral reflex may be small[19]. In our study we proved that there were reduction in occurrence of atonic PPH in cooling 3(2.7%) vs 10(9.1%) in non cooling group, but it is not significant *p value* (0.53). Also cooling of the uterus in our study reduces significantly the need for uterotonic drugs, uterine artery ligation, compression sutures, and internal iliac artery ligation *p value* (0.03). Our results comes as results accepted by Nawasirodom *et al*., 2019; which concluded that there were significant reduction in use of uterotonic drugs in uterine cooling group.18 Our method of uterine cooling during CS do not increases the incidence of wound sepsis.

CONCLUSIONS

Uterine cooling by iced saline decrease total blood loss, decrease incidence of atonic PPH and reduces the need for uterotonic drugs without increase in operative time or wound sepsis.

CONFLICT OF INTERESTS

There are no conflicts of interest.

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