Section A-Research paper

Keeping Cool: The Efficacy of Uterine Cooling in Reducing Postpartum Blood Loss

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Uterine Cooling and Blood Loss

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Abstract

Objective: To assess the effectiveness of uterine cooling during cesarean section in reducing postpartum blood loss.

Methods: This was a prospective cohort study of 39 patients undergoing cesarean section, who were divided into two groups: 19 patients in the uterine cooling group and 20 patients in the control group. Patients' basic characteristics, including maternal age, gestational age, and parity, were recorded. The mean volume of blood loss and the proportion of patients with blood loss greater than 30 ml were compared between the two groups.

Results: Patients in the uterine cooling and control groups had similar basic characteristics. The mean blood loss was significantly lower in the uterine cooling group (19.74 ml) than in the control group (28 ml) (P = 0.006). The proportion of patients with blood loss greater than 30 ml was also lower in the uterine cooling group than in the control group (21.05% vs. 55%, P = 0.048). The adjusted odds ratio for blood loss greater than 30 ml in the uterine cooling group was 0.15 (95% CI, 0.03-0.77; P = 0.023), after adjusting for maternal age, gestational age, and parity.

Conclusion: Uterine cooling during cesarean section is an effective technique for reducing postpartum blood loss. This finding has important implications for the management of postpartum hemorrhage (PPH) and warrants further investigation in larger randomized controlled trials.

Keywords: Postpartum hemorrhage, Uterine cooling, Cesarean section, Blood loss

Introduction

Cesarean section is a common surgery for delivering infants, particularly when vaginal delivery is not possible or is considered risky for the mother or her fetus. One of the suspected complications of cesarean section is PPH, which can increase maternal morbidity and mortality [(1)].

While many methods, including the use of uterotonics and compression devices, have been used to decrease blood loss after cesarean sections, they may not always be successful or suitable for all women [(2)].

Uterotonics are drugs that are used to stimulate uterine contractions and prevent or decrease PPH. They function by encouraging the smooth muscle of the uterus to contract, which helps decrease bleeding by compressing the blood vessels supplying the placenta and the uterus. There are several types of uterotonics, such as oxytocin, ergot derivatives, and prostaglandins [3, 4]. Oxytocin is the most usually used due to its safety and efficacy, while Carbitocin is a long-acting synthetic analog recommended as first-line therapy for post-partum hemorrhage in some guidelines [5, 6]. Ergot derivatives and prostaglandins are less commonly used due to risk of side effects. The clinical condition, the patient's medical history, and the preferences of the healthcare professional all have a role in the decision to use uterotonic [7].

Uterine cooling is a somewhat new technique that involves cooling the uterus during cesarean section to reduce blood loss by causing vasoconstriction and decreasing inflammation. However, there is little and inconsistent information regarding the effectiveness of uterine cooling for minimizing blood loss after cesarean sections [8, 9].

Therefore, this study aims to evaluate the effect of uterine cooling on postpartum blood loss during cesarean delivery and to compare it with a control group that does not receive uterine cooling. The findings of this study could participate to the development of evidence-based strategies for reducing blood loss during cesarean section and improving maternal outcomes.

Materials & Methods

Study design

This study is a prospective cohort study conducted at Aswan University Hospital from February 2019 to April 2022.

The participants were divided into two groups, the control group and the uterine-cooling group.

Participants

The study included 39 pregnant women who were scheduled for elective cesarean delivery, who were divided into two groups: 19 patients in the uterine cooling group and 20 patients in the control group. The inclusion criteria were singleton pregnancies with a cephalic presentation, gestational age 37-42 weeks, Hb above 10 mg/dl, and no previous history of uterine surgery. The exclusion criteria were placenta previa, fetal distress, coagulopathy, chorioamnionitis, severe anemia, thrombophilia, and contraindications to uterotonics. The inclusion criteria were cephalic-presenting singletons, gestational ages between 37 and 42 weeks, hemoglobin concentrations above 10 mg/dl, and a lack of prior uterine surgery.

Intervention

All women received either 10 IU oxytocin diluted in 500 ml of normal saline with an infusion rate adjusted to uterine tone, up to 500 ml/hour, or direct IV carbetocin injection over 2 minutes immediately after delivery. In the intervention group, an icy crushed sterile saline solution was applied to the exteriorized uterus for 3-5 minutes while repairing the hysterotomy incision, and

the ice was secured in place by hand or by wrapping a towel around it to maintain stability. To avoid cooling the skin, anterior abdominal wall, and intraperitoneal organs, the abdominal incision was wrapped with drier drapes. A menstrual cup with a maximum capacity of 30 ml was inserted into the vagina after washing with diluted saline mixed with povidone-iodine. Postpartum blood loss was assessed after one hour from cup insertion by carefully removing the cup and measuring the blood volume using a graduated plastic measure.

All patients were hemodynamically stable before the operation, and all received spinal anesthesia.

Outcome measures

The primary outcome measure was the amount of blood loss during the postpartum period, which was measured using a calibrated drape. Secondary outcome measures included the incidence of PPH, defined as blood loss equal 1000 mL or more, and the demand for more uterotonics or surgical interventions to control bleeding.

Data collection

Data were collected from patients' medical records, including demographic data, obstetric history, parity, and perioperative data.

Ethical considerations

The Aswan Faculty of Medicine's Institutional Review Board gave its approval to the study, and all subjects gave their written informed permission prior to participation.

Statistical analysis

The collected data were analyzed using STATA version 17 software. Continuous variables were presented as mean ± standard deviation and median. Categorical variables were presented as frequencies and percentages and were compared using Fisher's exact test. For Analysis we use the independent samples t-tests for the mean comparison and the Mann–Whitney test for the median. For outcome analysis, Fisher's exact test for proportions, and for the mean independent samples t-tests. Logistic regression analysis was used to assess the association between uterine cooling and PPH while adjusting for potential confounding factors.

Results

We enrolled 39 patients in this study; the patients were divided into two cohorts; 19 patients (48.72%) in the uterine cooling group and 20 patients (51.28%) in the control group. The basic characteristics of the two groups are shown in Table 1. We found that there was a non-significant difference between the two groups in all basic characteristics.

Primary analysis:

There was a significant difference in the mean volume of blood loss in the two groups, in the uterine cooling group the mean was 19.74 ml ± 10.2, and in the no-cooling group 28 ml ± 7.33, [P 0.006], as shown in figure 1, the mean difference was 8.26 ml; 95% CI, 2.45-14.08. Among the 15 patients who had blood loss of more than 30 ml, 4 patients (21.05%) were in the uterine cooling group and 11 patients (55%) were in the no cooling group, with a significant difference P 0.048 (table 2) (figure 1).

Multiple logistic regression analysis of predictors of primary outcomes regarding the studied groups. The adjusted odds ratio (OR) for patients who have blood loss ≥ 30 ml in association to uterine cooling is 0.15; 95% CI, 0.03-0.77, P 0.023, adjusted for maternal age, gestational age, and parity (table 3).

Discussion

The results revealed a significant difference in mean blood loss amount between the two groups, with the uterine cooling group having less blood loss compared to the control group. The adjusted odds ratio in this trial, which takes into account variables like maternal age, gestational age, and parity that could be confounding, further supports the idea that uterine cooling is useful in lowering blood loss. The suggested mechanism for effectiveness of uterine cooling is that it stimulate vasoconstriction, which can reduce blood loss during surgery [(10)]. Inflammation and edema can be reduced by cooling the uterus in conjunction with the somatovisceral reflex, which will help lessen bleeding. These physiological alterations may result in less bleeding during surgery and better patient outcomes [(11)]. These outcomes confirm earlier research demonstrating the efficiency of uterine cooling in lowering PPH. One such study by *Nawasirodom et al.* (2019) found a significant reduction in intraoperative blood loss in the cooling group compared to the non-cooling group during cesarean section. They also discovered that the cooling group used fewer uterotonic drugs. The study authors concluded that uterine cooling is associated with reduced blood loss during cesarean section in pregnant women. These findings are consistent with previous studies that have demonstrated the effectiveness of uterine cooling in reducing

PPH [9]. Using cold packing compression on the lower abdomen after vaginal delivery to minimize blood loss was the subject of a randomized controlled trial in 2022.Results showed that mean blood loss was significantly reduced in the group using cold pack compression compared to the standard vaginal delivery group. No participants in either group experienced PPH or needed blood transfusion. Additionally, no adverse events were reported in the cold pack compression group. The study concludes that using cold pack compression after childbirth could significantly reduce blood loss without causing harm [12]. On the other hand, *Zarabadipour* carried out a study to evaluate the impact of oxytocin and cooling the lower abdomen on postpartum blood loss in vaginal birth. The administration of an icepack was thought to be a non-pharmacological and cost-effective strategy that might be used in place of oxytocin to lessen blood loss after delivery, but the study found no significant different in blood loss across the groups. The only complication in the intervention group in *Zarabadipour's* study was an uncomfortable cold feeling in the abdominal area [13].

In summary, the results of the study are consistent with other relevant studies, which suggest that uterine cooling throughout cesarean section can decrease blood loss and improve outcomes for women. However, further research is needed to determine the optimal cooling protocol and to evaluate the long-term effects of uterine cooling on maternal and neonatal outcomes. The sample size of this study is relatively small, which may limit the generalizability of the results. Further studies with larger sample sizes are needed to confirm these findings. Additionally, it is important to note that uterine cooling should be used as a complementary technique to other interventions, such as uterotonics and uterine massage, in the management of PPH. Moreover, the study was conducted at a single center.

Conclusion

The results of the study provide preliminary evidence that uterine cooling during cesarean section can be an effective method for reducing blood loss. However, further research is needed to confirm these findings and to determine the optimal cooling protocol for cesarean section.

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Table (1): Comparison between uterine cooling and no cooling groups regarding patients' basic characteristics.

Characteristics	Uterine Cooling	No cooling	P value
Maternal Age, mean (SD), (years)	33.95 (± 5.62)	30.6 (± 5.26)	0.071
Gestational age, mean (SD), (weeks)	38 (± 1.05)	38.35 (± 0.87)	0.265
Parity, median (IQR)	2 (1-5)	2 (1-3)	0.555

Table (2): Comparison between uterine cooling and no cooling groups regarding patients' outcome.

outcomes	Uterine Cooling	No cooling	P value
Blood loss, mean (SD), (ml)	19.74 (± 10.20)	28 (± 7.33)	0.006
Blood loss ≥ 30 ml	4 (21.05%)	11 (55%)	0.048

Table (3): Multiple logistic regression analysis of predictors of primary outcomes regarding the studied groups.

Outcome	Uterine Cooling	No cooling	Adjusted Odds ratio	Confidence interval	P value
Blood loss ≥ 30 ml	4 (21.05%)	11 (55%)	0.15	0.03-0.77	0.023

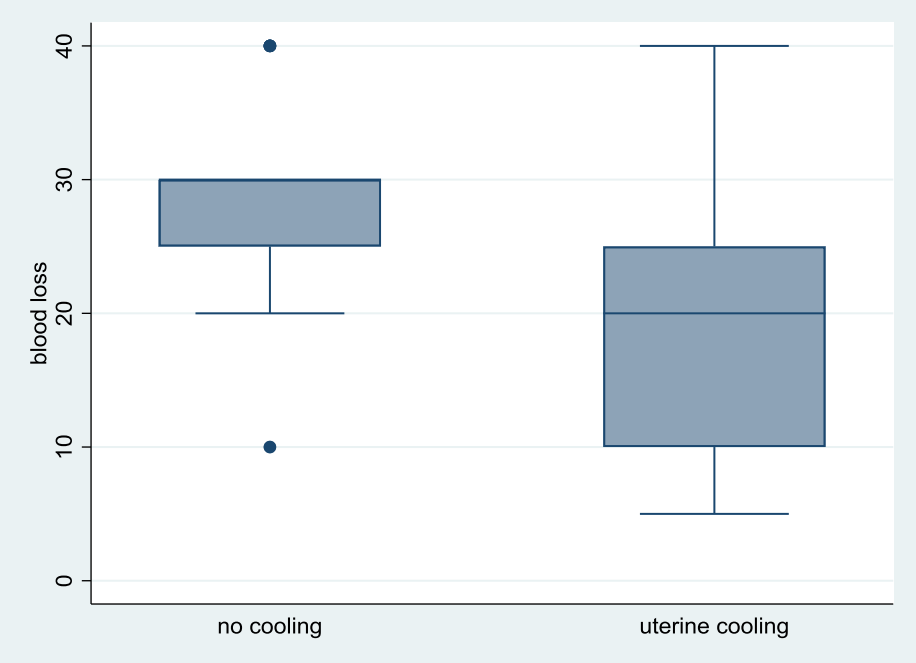

Figure 1. Effect of uterine cooling on volume of blood loss