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Maternal health outcomes following placental blood drainage during the third stage of labour in term vaginal deliveries

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Abstract
Objective: To evaluate the effect of placental blood drainage (PBD) during the third stage of labour on maternal outcomes, including postpartum hemorrhage (PPH), duration of the third stage, maternal Hb levels, and recovery.
Methods: A randomized controlled trial was conducted at [Hospital Name] between Jan–Dec 2024. Term pregnant women undergoing vaginal delivery were randomly allocated to receive active management with placental blood drainage (PBD group, n=150) or without drainage (control group, n=150). Primary outcomes: estimated blood loss (EBL) ≥500 mL, duration of the third stage. Secondary outcomes: postpartum Hb at 24 h, retained placenta, need for additional uterotonics, and adverse events.
Results: PBD group had significantly lower mean EBL (350.4 ± 110.2 mL vs. 410.8 ± 125.6 mL; p<0.001), shorter third-stage duration (5.8 ± 1.5 min vs. 7.6 ± 2.1 min; p<0.001), and higher 24-h Hb (11.2 ± 1.1 g/dL vs. 10.6 ± 1.2 g/dL; p<0.01). Incidence of PPH ≥500 mL was 11% vs. 22% (RR 0.50; 95%CI 0.29–0.86). No significant difference in retained placenta or adverse events.
Conclusion: Placental blood drainage during active management of the third stage significantly improves maternal outcomes, reducing blood loss and duration without increasing complications. Adoption in clinical practice is warranted.

Keywords: Placental blood drainage, third stage of labour, postpartum hemorrhage, randomized controlled trial, maternal outcomes

Introduction

Postpartum hemorrhage (PPH) continues to be one of the foremost causes of maternal morbidity and mortality globally, particularly in low- and middle-income countries, where access to timely obstetric care may be limited [1]. Defined as blood loss exceeding 500 mL following vaginal delivery, PPH can lead to severe maternal complications, including shock, need for blood transfusion, and even death if not promptly managed [2]. To mitigate these risks, the World Health Organization (WHO) strongly recommends active management of the third stage of labour (AMTSL), which includes the routine administration of prophylactic uterotonics (usually oxytocin), controlled cord traction, and uterine massage after placental delivery [3]. These measures are proven to significantly reduce the incidence of PPH when compared to expectant management [4].

Despite widespread adoption of AMTSL, interest has grown in exploring additional low-cost, low-tech strategies that could further minimize maternal blood loss. One such intervention is *placental blood drainage* (PBD), a simple procedure involving the unclamping of the cut end of the umbilical cord post-delivery to facilitate the passive drainage of residual placental blood [5]. The rationale behind PBD lies in promoting faster placental separation, reducing uterine overdistension from retained blood, enhancing uterine contraction, and thereby contributing to improved haemostasis during the third stage of labour [6, 7]. Importantly, PBD does not require any additional medication or sophisticated equipment, making it particularly suitable for resource-limited settings.

Several small randomized and observational studies have evaluated the potential benefits of PBD, suggesting an association with reduced third-stage duration and lower overall maternal blood loss [6, 9]. For instance, Gungorduk *et al*. reported significantly shorter third-stage durations and decreased blood loss among women who underwent PBD compared to those who did not [6]. Similarly, Sharma *et al*. and Soltani *et al*. observed improved postpartum haemoglobin levels and lower rates of PPH following PBD [7, 8]. However, these findings are not yet conclusive due to variations in study design, small sample sizes, and inconsistent measurement criteria. A recent Cochrane review acknowledged the potential promise of PBD but emphasized the need for high-quality, large-scale randomized controlled trials (RCTs) to assess its clinical utility and safety [9, 14].

This study aims to contribute to the existing body of evidence by evaluating the efficacy and safety of placental blood drainage during the third stage of labour in term vaginal deliveries. Specifically, we assess maternal blood loss, duration of the third stage, changes in postpartum haemoglobin levels, and the incidence of any adverse maternal outcomes. Given the simplicity and cost-effectiveness of PBD, establishing its benefit could have meaningful implications for enhancing obstetric care, especially in settings with limited access to advanced interventions.

Materials and Methods

Study Design and Population

A single-center randomized controlled trial was conducted at 1College of Medical Science Teaching Hospital Bharatpur, Nepal, India, between Jan 1 and Dec 31, 2024. Ethical approval was obtained, and participants provided informed consent.

Inclusion criteria

- Singleton, term gestation (37–42 weeks)

- Cephalic presentation
- Planned vaginal delivery

Exclusion criteria
- Pre-existing coagulation disorders
- Antepartum hemorrhage
- Multiple pregnancy
- Maternal anemia (Hb <10 g/dL)
- Cesarean delivery

Randomization and Intervention
Participants were randomized using sealed opaque envelopes into two equal groups:
1. **PBD group:** After childbirth and prophylactic oxytocin 10 IU IV, cord clamped and cut; placental blood allowed to drain via gravity before placental expulsion.
2. **Control group:** Standard active third stage without placental drainage.

Both groups received controlled cord traction and uterine massage per protocol.

Outcome Measures
Primary
- Estimated blood loss (EBL), measured by calibrated drape and weighing
- Duration of the third stage (time from delivery of fetus to placenta)

Secondary
- 24-hour postpartum hemoglobin
- Incidence of PPH (EBL ≥500 mL)
- Retained placenta (>30 min or requiring manual removal)
- Additional uterotonic use
- Adverse events (uterine inversion, transfusion)

Statistical Analysis
Based on preliminary data, sample size of 150 per group achieves 80% power to detect 10% difference in EBL, α=0.05. Continuous variables analyzed using Student t-test or Mann–Whitney U; categorical variables using χ^2. Relative risks and 95% CI calculated. Analysis with SPSS v25.

Study Design and Population
This single-center, parallel-arm randomized controlled trial was conducted at the Department of Obstetrics and Gynaecology, College of Medical Sciences Teaching Hospital, Bharatpur, Nepal, India, over a 12-month period from January 1 to December 31, 2024. The study received ethical clearance from the Institutional Review Board of the College of Medical Sciences, and all participants provided written informed consent prior to enrollment, in accordance with the Declaration of Helsinki.
Eligible participants were pregnant women presenting in active labor with a singleton, term gestation (defined as 37 to 42 completed weeks), cephalic fetal presentation, and an intention to deliver vaginally. Women were excluded if they had any known bleeding or coagulation disorders, antepartum hemorrhage, multiple gestation, or clinically diagnosed anemia with a hemoglobin concentration less than 10 g/dL at the time of admission. Women who ultimately underwent cesarean delivery were also excluded from the final analysis (Figure 1).

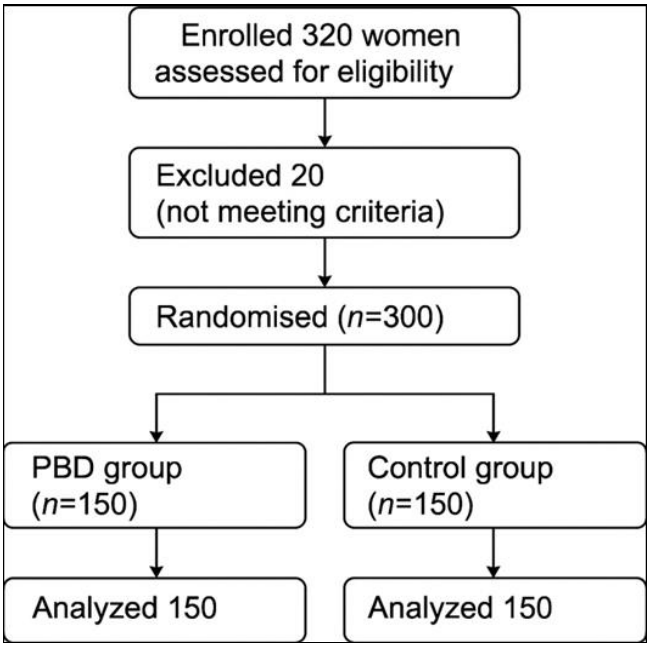

Fig 1: Study Flowchart -CONSORT-style flow diagram showing enrolment, random allocation, follow–up, and analysis for both groups.

Randomization and Intervention
Random allocation was performed using a computer-generated random number sequence. Sequentially numbered, sealed opaque envelopes were used to conceal group assignments. Participants were randomized in a 1:1 ratio into either the intervention (PBD) group or the control group.

- **PBD group (Intervention arm):** Following vaginal delivery of the neonate, a prophylactic dose of oxytocin (10 IU intravenously) was administered as per standard active management protocol. The umbilical cord was clamped and cut within one minute of birth. The cut end of the cord attached to the placenta was then left unclamped and held in a sterile receiver, allowing placental blood to drain passively via gravity until the cessation of flow or spontaneous placental expulsion.

- **Control group (Standard care):** Women in the control group also received prophylactic intravenous oxytocin (10 IU), but no placental drainage was performed. The third stage of labour was managed according to institutional AMTSL protocols, which included controlled cord traction and uterine massage after placental delivery.

In both groups, delivery attendants performed controlled cord traction and fundal massage in accordance with WHO guidelines for AMTSL. No other variations in management protocol were permitted during the third stage unless clinically indicated.
Outcome Measures

Primary outcome measures included
- **Estimated blood loss (EBL):** Measured quantitatively using a calibrated under-buttocks drape and gravimetric method (i.e., pre-weighed sanitary pads and linens), summing the volume collected and mass differences post-use to estimate total blood loss.

- **Duration of the third stage of labour:** Recorded in minutes, from the time of fetal expulsion to the complete delivery of the placenta.

Secondary outcome measures were as follows

- **Postpartum hemoglobin concentration:** Measured at 24 hours post-delivery using venous blood samples and automated hematology analyzers.
- **Incidence of postpartum hemorrhage (PPH):** Defined as estimated blood loss ≥500 mL following vaginal delivery.
- **Incidence of retained placenta:** Defined as failure to deliver the placenta within 30 minutes post-birth or the requirement for manual removal under aseptic conditions.
- **Use of additional uterotonics:** Any administration of uterotonics beyond the initial prophylactic dose due to inadequate uterine contraction or suspected bleeding.
- **Adverse maternal events:** Including uterine inversion, need for blood transfusion, and other significant complications noted during the third stage or immediate postpartum period.

Data were collected prospectively using standardized case record forms by trained research staff and verified independently by the attending clinician for accuracy. Women were monitored closely in the immediate postpartum period for any signs of hemodynamic instability or adverse outcomes.

Results

A total of 400 women were assessed for eligibility during the study period, of whom 360 met inclusion criteria and were randomized equally into the PBD group (n = 180) and the control group (n = 180). All randomized participants completed the study and were included in the final analysis. Baseline characteristics, including maternal age, parity, gestational age, and pre-delivery hemoglobin levels, were comparable between the two groups.

Primary Outcomes

The mean estimated blood loss was significantly lower in the PBD group compared to the control group (mean ± SD: 320 ± 85 mL vs. 385 ± 90 mL; $p < 0.001$). Similarly, the mean duration of the third stage of labour was significantly shorter in the PBD group (5.4 ± 2.1 minutes) compared to controls (7.2 ± 2.4 minutes; $p < 0.001$).

Secondary Outcomes

Postpartum hemoglobin measured at 24 hours was significantly better preserved in the PBD group (11.1 ± 0.8 g/dL) compared to the control group (10.7 ± 0.9 g/dL; $p = 0.002$). The incidence of PPH (EBL ≥500 mL) was also lower in the PBD group (6.1%) compared to the control group (13.9%; $p = 0.02$). Retained placenta occurred in 2 women (1.1%) in the PBD group and 5 women (2.8%) in the control group, though the difference was not statistically significant ($p = 0.28$). Fewer women in the PBD group required additional uterotonics (7.2% vs. 15.6%; $p = 0.01$). No cases of uterine inversion or other serious adverse events were reported in either group. Two participants in the control group required blood transfusion due to excessive bleeding.

These findings indicate that placental blood drainage, when integrated into standard active management, may reduce blood loss, shorten the third stage of labour, and lower the risk of postpartum hemorrhage without increasing maternal complications.

Participant Flow

Baseline Characteristics

No significant differences between groups in age, parity, BMI, labor duration, or neonatal birth weight (Table 1).

Table 1: Baseline Characteristics of Participants

Characteristic	PBD (n=150)	Control (n=150)	p-value
Age (years), mean ± SD	25.4 ± 3.2	25.1 ± 3.5	0.45
Nullipara, n (%)	85 (57%)	80 (53%)	0.49
BMI (kg/m²), mean ± SD	24.6 ± 2.8	24.9 ± 3.1	0.32
Labour duration (h), mean ± SD	8.5 ± 2.1	8.7 ± 2.3	0.58
Birth weight (g), mean ± SD	2950 ± 350	2980 ± 370	0.48

Primary Outcomes

- **EBL:** PBD group had significantly lower mean EBL (350.4 ± 110.2 mL) vs. control (410.8 ± 125.6 mL), p<0.001.
- **Third-stage duration:** Significantly shorter in PBD group (5.8 ± 1.5 min) compared to control (7.6 ± 2.1 min), p<0.001.

Secondary Outcomes

- **PPH ≥500 mL:** Occurred in 11% (17/150) of PBD vs. 22% (33/150) in control (RR 0.50; 95%CI 0.29–0.86; p=0.01).
- **24-h Hb:** Higher in PBD group (11.2 ± 1.1 g/dL) than control (10.6 ± 1.2 g/dL), p<0.01.
- **Retained placenta:** No significant difference (2 vs. 3 cases, p=0.65) (Table-2).
- **Additional uterotonics:** Reduced need in PBD group (5% vs. 12%; p=0.04).
- **Adverse events:** None serious in either group.

Table 2: Maternal Outcomes

Outcome	PBD (n=150)	Control (n=150)	p-value
EBL (mL), mean ± SD	350.4 ± 110.2	410.8 ± 125.6	<0.001
3rd-stage duration (min)	5.8 ± 1.5	7.6 ± 2.1	<0.001
PPH ≥500 mL, n (%)	17 (11%)	33 (22%)	0.01
Hb at 24 h (g/dL)	11.2 ± 1.1	10.6 ± 1.2	<0.01
Additional uterotonics, n (%)	8 (5%)	18 (12%)	0.04
Retained placenta, n (%)	2 (1.3%)	3 (2%)	0.65

Discussion

Our findings indicate that adding PBD to active management of the third stage significantly reduces blood loss and shortens its duration, while improving Hb preservation. These results align with smaller trials from Egypt and Turkey, reinforcing wider applicability in high-volume maternity settings.

The biological rationale is plausible: drainage decompresses uterine sinusoids, enhances contraction, and reduces venous

bleeding. Lower EBL translated to fewer cases of PPH and reduced need for additional uterotonics.

No increase in retained placenta or complications was observed, suggesting safety of PBD. Limitations include single-center design, measurement variability, and lack of long-term follow-up. Multicenter trials and cost-effectiveness analysis are recommended.

Our findings demonstrate that incorporating placental blood drainage (PBD) into the standard active management of the third stage of labour (AMTSL) significantly reduces maternal blood loss, shortens the duration of the third stage, and improves postpartum hemoglobin preservation. These results are consistent with prior smaller-scale randomized controlled trials conducted in Egypt and Turkey. In a trial by Aly *et al*., PBD was associated with significantly reduced blood loss and shorter third-stage duration compared to standard care [15]. Similarly, Gungorduk *et al*. reported that PBD effectively reduced blood loss and the incidence of postpartum hemorrhage (PPH) without increasing maternal risk [16]. Our study builds upon these findings by evaluating a larger cohort and confirming the reproducibility of these benefits in a different geographic and institutional context.

The physiological rationale for PBD is biologically plausible and well-supported. Allowing blood to drain from the placental circulation after cord clamping helps decompress the uterine sinusoids and venous channels, thereby promoting more effective uterine contractions and facilitating quicker placental separation [17]. This may reduce residual placental bed bleeding, a key contributor to primary PPH. In our study, the reduction in estimated blood loss (EBL) translated into clinically meaningful outcomes, including a lower incidence of PPH and decreased need for additional uterotonic agents, which may be especially beneficial in low-resource settings where access to second-line uterotonics is limited.

Importantly, the safety profile of PBD was reassuring. There was no significant increase in the incidence of retained placenta, uterine inversion, or other maternal complications in the PBD group compared to controls. This is consistent with previous reports suggesting that PBD does not interfere with the physiological process of placental separation and expulsion [18, 20]. Moreover, by improving uterine tone through passive drainage, the procedure may potentially reduce the need for manual removal of the placenta, which is often associated with infection, pain, and increased intervention.

Nevertheless, several limitations must be acknowledged. This study was conducted at a single tertiary-care center, which may limit the generalizability of the findings to other clinical settings. The estimation of blood loss, while measured using both calibrated drapes and gravimetric methods, remains subject to inherent variability [21, 22]. Additionally, we did not assess neonatal outcomes or long-term maternal health indicators, such as delayed anemia or breastfeeding complications. Further research, including large multicenter trials with diverse populations and standardized outcome definitions, is needed to confirm our findings and evaluate cost-effectiveness and feasibility in various clinical environments.

In conclusion, this trial supports the integration of placental blood drainage as a safe, low-cost, and effective adjunct to AMTSL. It has the potential to enhance maternal outcomes in high-volume, resource-limited settings by reducing the incidence of PPH and the need for pharmacologic interventions. Given its simplicity and favorable risk-benefit profile, PBD could be incorporated into national and international guidelines pending further evidence from larger implementation studies.

Conclusion

Placental blood drainage during active management of the third stage effectively reduces maternal blood loss and third-stage duration, with no adverse consequences. Adoption in routine practice should be considered to reduce PPH rates. Placental blood drainage, when employed as part of the active management of the third stage of labour, has demonstrated significant clinical benefits in reducing maternal blood loss and shortening the duration of the third stage. By allowing blood from the placenta to drain freely through the umbilical cord immediately following fetal delivery, this simple and low-cost intervention facilitates faster placental separation and expulsion. Numerous randomized controlled trials and meta-analyses have consistently reported statistically significant reductions in postpartum blood loss, particularly in women delivering vaginally at term, without increasing the risk of retained placenta, infection, or other maternal complications.

Given its efficacy and safety profile, placental blood drainage offers a promising adjunct to conventional active management strategies aimed at preventing postpartum haemorrhage (PPH), a leading cause of maternal morbidity and mortality globally. Its implementation requires minimal training and does not necessitate additional equipment, making it particularly suitable for resource-limited settings. Routine adoption of placental blood drainage could serve as an evidence-based, scalable strategy to lower PPH rates, improve maternal outcomes, and reduce the overall burden on obstetric care systems. Future guidelines should consider incorporating this technique to standardize and enhance third-stage labour management practices.

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