



Research Paper

The effect of water immersion during first stage of labor on postpartum blood loss

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ABSTRACT

Introduction: Water immersion is a non-pharmacological method of pain relief during labor. Its safety for both the mother and the newborn has been established. Obstetric hemorrhage remains a major cause of maternal morbidity. This study evaluated the effect of water immersion during the first stage of labor on postpartum blood loss.

Aim: To assess whether water immersion during the first stage of labor influences postpartum blood loss and the incidence of postpartum hemorrhage (PPH) in low-risk women.

Material and methods: This cohort study included 240 women with singleton pregnancies at 37–41 weeks of gestation who met the eligibility criteria for water immersion. The study group consisted of 102 women who used water immersion, while 138 women served as controls. Participants self-selected into groups. Water immersion lasted 60 minutes. Blood loss was assessed visually by a midwife immediately after delivery. Hemoglobin (Hb) levels were measured on admission and 24 h postpartum. Continuous variables were compared using independent t-test, and categorical variables using χ^2 test or Fisher's exact test. A p -value < 0.05 was considered statistically significant.

Results and discussion: No significant differences were observed between the water immersion and control groups in estimated blood loss ($p = 0.09$) or hemoglobin change ($p = 0.81$). Multivariable regression showed that water immersion was not independently associated with postpartum blood loss ($p = 0.565$).

Conclusions: Water immersion during the first stage of labor was not associated with increased postpartum blood loss or a higher incidence of PPH. These findings support water immersion as a safe non-pharmacological method of labor management in low-risk women.

1. INTRODUCTION

Water immersion is a non-pharmacological method of pain relief during labor with a long history in medical care.¹ It has become increasingly popular and is associated with less painful contractions, shorter labor, lower anxiety levels, improved maternal satisfaction, and beneficial effects on maternal–fetal circulation.^{2–5} In healthy women at low risk of complications, there is no evidence of increased adverse effects on either the mother or the newborn associated with laboring in water.^{6,7}

Postpartum hemorrhage (PPH) remains one of the leading causes of maternal morbidity and mortality worldwide.⁸ The traditional definition of PPH is blood loss exceeding 500 mL after vaginal delivery or 1000 mL after cesarean delivery, although more recent definitions also consider clinical signs and symptoms of hypovolemia.⁹ Visual estimation of blood loss is subjective and may lead to underestimation or overestimation depending on the severity of bleeding; however, it remains the most commonly used method in routine obstetric practice.¹⁰ Laboratory findings, including a decrease in hemoglobin concentration of at least 2 g/dL, may provide additional evidence of postpartum hemorrhage.¹¹ Clinical manifestations of hypovolemia often do not occur until blood loss exceeds approximately 25% of total blood volume.¹² Blood loss may be assessed by visual estimation or quantitative methods, although a recent Cochrane review found no evidence that quantitative blood loss assessment improves clinical outcomes.^{13,14}

The effect of water immersion on postpartum blood loss has been evaluated in several studies with inconsistent results. A Cochrane review including studies published between 1990 and 2015 found insufficient evidence to determine the effect of water immersion during the first stage of labor on estimated blood loss.¹⁵ Another systematic review and meta-analysis including 22 studies (20 observational studies and two randomized controlled trials [RCTs]) reported that water immersion was associated with a low risk of major PPH; however, substantial heterogeneity among studies was noted, and the authors recommended further research.⁷ In contrast, a retrospective observational study published in 2023 reported a higher incidence of hemorrhage among women who underwent water immersion compared with those who did not receive this intervention.¹⁶ Therefore, further studies are needed to clarify the relationship between water immersion during labor and postpartum blood loss.

2. AIM

The aim of this study was to evaluate the effect of water immersion during the first stage of labor on postpartum blood loss and the risk of PPH.

3. MATERIAL AND METHODS

3.1. Study design and participants

This cohort study was conducted from October 2021 to October 2022. The study included women with uncomplicated

singleton pregnancies between 37 and 41 weeks of gestation with regular spontaneous contractions causing significant cervical changes, cervical dilation of at least 3–4 cm, and a reassuring fetal heart rate pattern on cardiotocography (CTG), who were admitted to a level 2 birthing suite. Patients with multifetal pregnancy, preterm birth, trial of labor after cesarean section, skin lesions, skin infections, vaginal bleeding, body temperature >37.5 °C, infectious diseases, genital herpes, or requiring induction of labor or augmentation with uterotonic agents at any stage of labor were excluded. Women receiving other methods of labor analgesia, including epidural anesthesia, were also excluded. Participants self-selected into the study or control group. A total of 240 spontaneous vaginal deliveries were analyzed. The water immersion group comprised 102 women, whereas the control group consisted of 138 women who did not use water immersion. Participants' characteristics are presented in [Table 1](#).

Table 1. Participants' profile.

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- Low-risk singleton pregnancy
 - 37–41 weeks of gestation
 - Regular uterine contractions causing significant changes of the cervix
 - Cervical dilation at least 3–4 cm
 - A reassuring pattern of Fetal Heart Rate on CTG
 - The good general condition of the parturient
 - Good cooperation with a caregiver with urgent removal from the tub in case of emergency
-

3.2. Intervention and intrapartum management

Water immersion was performed in a dedicated birthing tub for approximately 60 minutes. During immersion, fetal heart rate and maternal condition were monitored according to local hospital protocols for low-risk labor. Fetal monitoring was performed using a waterproof wireless CTG telemetry device that enabled continuous assessment of fetal heart rate during immersion. Maternal observations included regular assessment of body temperature, blood pressure, and pulse rate. Cleaning and disinfection procedures were performed after each use according to hospital infection-control protocols.

The third stage of labor was managed expectantly in accordance with physiological management principles. The placenta was delivered spontaneously, and routine controlled cord traction and uterine massage were not performed. Immediately after delivery of the newborn, a sterile drape was placed under the mother's buttocks. Blood from placental delivery and perineorrhaphy was collected in the drape. Blood mixed with amniotic fluid during labor was not included in the assessment.

3.3. Outcome measures

For the purposes of this study, postpartum hemorrhage (PPH) was defined as visually estimated blood loss ≥ 500 mL following vaginal delivery. Upon completion of perineorrhaphy, the attending midwife visually estimated the total volume of postpartum blood loss collected in the drape. Because of the nature of the intervention, blinding of the attending midwife to group allocation was not possible.

In addition to visual blood loss assessment, changes in maternal hemoglobin concentration were analyzed. Blood samples were obtained on admission to the labor ward and again 24 hours after delivery.

3.4. Statistical analysis

Continuous variables were compared using the independent t-test. Categorical variables were analyzed using the χ^2 test or Fisher's exact test when appropriate. A p -value <0.05 was considered statistically significant. In addition, a multivariable linear regression model was performed to evaluate the independent association between water immersion and postpartum blood loss after adjustment for parity and baseline hemoglobin level. Regression coefficients (β) with 95% confidence intervals (CI) were calculated.

4. RESULTS

From October 2021 to October 2022, a total of 240 physiological term deliveries between 37 and 41 weeks were analyzed. Of the analyzed deliveries, 102 patients underwent water immersion and 138 did not use additional methods of labor pain relief. Maternal characteristics were generally comparable between women who underwent water immersion and those in the control group (Table 2). Baseline hemoglobin levels were slightly lower in the immersion group compared with the non-immersion group (12.15 ± 1.24 vs 12.53 ± 1.03 g/dL, $p = 0.02$). The amount of blood loss assessed by the visual method was not statistically significantly different between women who received water immersion and those in the group without water immersion ($p = 0.09$). Women with water immersion had a mean blood loss of 371.35 (42.76) mL, while women without water immersion had a mean blood loss of 381.82 (62.71) mL. The change in hemoglobin levels was not statistically significantly different between women in whom water immersion was used and those in the group without water immersion ($p = 0.81$). In parturients with water immersion, the reduction in hemoglobin levels assessed 24 hours after delivery averaged 0.995 g/dL, while women without water immersion averaged 1.022 g/dL. Statistical results are shown in Figure 1. To address potential confounding, a multivariable linear regression analysis was performed with postpartum blood loss as the dependent variable. After adjustment for parity and baseline hemoglobin

level, water immersion was not independently associated with postpartum blood loss ($\beta = 2.54$ mL; 95% CI -6.15 to 11.23 ; $p = 0.565$).

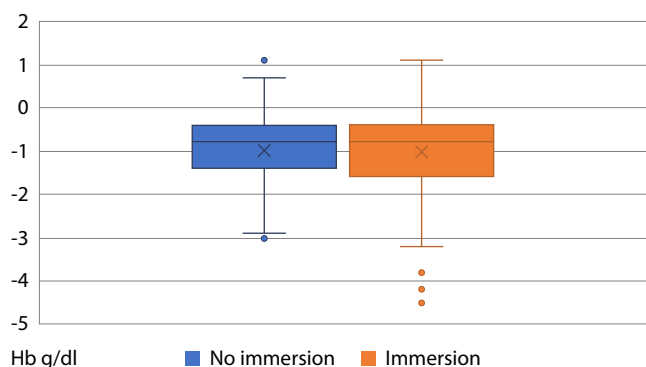


Figure 1. Change in haemoglobin levels 24 hours after delivery.

5. DISCUSSION

In the present study, no significant association was observed between water immersion during the first stage of labor and postpartum blood loss or PPH. A total of 5 women had PPH; all of them were minor: in the immersion group 3 (2.9%) and in the non-immersion group 2 (1.5%). The differences were not statistically significant. There was also no major PPH reported. Available literature includes four prospective cohort studies^{3,5,17,18} and two RCTs^{19,20} evaluating the incidence of PPH among women who used water immersion during labor. The authors emphasized that measurements of some intrapartum outcomes, such as PPH, were subjective, which may have resulted in measurement error. There is also limited information provided about assessment of blood loss and management of the third stage of labor. A Cochrane review conducted in 2010 showed fewer women had PPH with active management of the third stage of labor.²¹ However, the evidence is inconclusive for women at low risk of childbirth complications. In 2010, Fahy et al., in a large observational study, suggested that physiological management of the third stage of labor does not increase the risk of PPH in women with uncomplicated pregnancy.²² In the present study, management of the third stage of labor was physiological. In the

Table 2. Comparison of the groups.

Variables	Immersion, n = 102, Mean (SD)	No immersion, n = 138, Mean (SD)	p -value
Age, years	30.82 (5.2)	29.76 (4.96)	0.41
Height, cm	166.85 (5.6)	165.91 (5.12)	0.14
Weight, kg	77.92 (12.25)	78.06 (13.42)	0.87
Gestational age, weeks	39.32 (0.82)	39.12 (1.08)	0.30
Parity, nulliparous / parous (≥ 1)	45 / 57	67 / 71	0.42
Baseline hemoglobin, g/dL	12.15 (1.24)	12.53 (1.03)	0.02

available publications, data on the amount of postpartum blood loss when water immersion is used in the first stage of labor are scarce. Most often the authors reported the occurrence of PPH without indicating information about the specific volume of blood lost. In 1998, Kuusela et al. evaluated blood loss in a group of parturients in whom immersion was used during the first stage of labor.²³ According to the author, the mean blood loss in the immersion group was 315 mL compared with 290 mL in the control group. In 2000, Taha et al. evaluated blood loss in a group with water immersion and without immersion.²⁴ In the group with water immersion, the authors observed a mean blood loss of 216 mL compared with 240 mL in the control group. In both of the above studies, there are no data on how determination of blood loss was assessed. The authors did not find a significant difference in postpartum blood loss between the groups (mean difference (MD) -14.33 ; 95% CI -63.03 to 34.37). In the present study, the amount of blood loss did not differ between women who received water immersion and the group without immersion ($p = 0.09$). Furthermore, multivariable linear regression analysis adjusted for parity and baseline hemoglobin level confirmed that water immersion was not independently associated with postpartum blood loss. It should be noted that blood loss was assessed using a visual method. After delivery blood was collected in the drape, subsequently the nurse visually estimated the volume of postpartum blood loss (in milliliters). Visual assessment of blood loss is currently the primary method used in the delivery suite. The visual method is subjective. In studies comparing visual assessment and objective measurement of blood loss, it has been shown that the visual method is associated with underestimation of loss in cases of heavy bleeding and overestimation when the actual loss is low.^{25–27} The authors also indicated that specialty, age, or clinical experience does not improve the sensitivity of the visual method.²⁸ In recent years, comparisons have been made between visual and quantitative methods both on simulators and during labor in the delivery suite.^{25,27} In 2013, Lertbunnaphong et al. found a statistically significant difference between visual and quantitative measurement; the difference was 80.4 (41.8) mL ($p < 0.0001$).²⁹ Although quantitative measurement is more accurate than visual assessment, RCTs conducted in India and in several European countries have not shown that the use of quantitative techniques decreases the rate of diagnosis of obstetric hemorrhage or improves perinatal outcomes.³⁰ A Cochrane review of three international studies found no statistically significant difference between visual and quantitative assessment of postpartum blood loss regarding blood transfusion rates (RR 0.82; 95% CI 0.46–1.46) and administration of uterotonic medications (RR 0.87; 95% CI 0.42–1.76).¹⁴ It is worth noting that to date, no gold standard has been established for assessing the volume of perioperative blood loss. From a clinical point of view, follow-up laboratory tests are important. Currently, there are several mathematical formulas for assessing blood loss, including the Moore, Nadler, and ICSH formulas.^{31,32} In 2020, Jaramillo et al. analyzed the mathematical formulas currently in use. The authors indicated

that the assessment of hemoglobin mass loss may have the highest sensitivity among the analyzed formulas, while stressing that additional studies are needed to confirm the usefulness of this method in improving perioperative care.³³ In the present study, the mean Hb decrease assessed 24 hours after delivery in parturients with water immersion was approximately 0.995 g/dL, while 1.022 g/dL was measured in those without water immersion. The change in hemoglobin levels was not statistically significantly different between groups ($p = 0.81$). In 2020, Yefet et al. presented a study aimed at exploring the physiologic patterns of Hb following vaginal delivery in patients without PPH or with occult or overt PPH. A complete blood count (CBC) was performed before and after delivery. In women without PPH, the mean Hb decrease was approximately 1 g/dL, while decreases of 2 g/dL and 3 g/dL were measured in women with occult PPH or overt PPH, respectively.¹¹ More research is required to explore the additional benefits of water immersion for labor and birth. Future studies should also assess maternal satisfaction, pain relief, postpartum infection rates, and perineal wound healing following water immersion during labor. It would be beneficial to explore the factors influencing midwives and doctors to offer water immersion for labor and birth, as well as the barriers and facilitators to offering this service in the maternity environment. An important limitation of this study is its non-randomized design. Participants self-selected into the immersion and non-immersion groups, which may have introduced selection bias and residual confounding. Women who chose water immersion may have had different attitudes toward labor interventions compared with women in the control group. In addition, visual estimation of blood loss was performed by attending midwives who were aware of group allocation, creating a potential source of measurement bias. Finally, the low number of PPH events and the relatively small sample size reduced the statistical power to detect differences in PPH incidence between groups. Strengths of this study include complete data collection and assessment of follow-up laboratory tests, which objectively confirmed no adverse effect on blood loss.

6. CONCLUSIONS

In this cohort study of low-risk women with uncomplicated singleton pregnancies, water immersion during the first stage of labor was not associated with increased postpartum blood loss or a higher incidence of postpartum hemorrhage. Furthermore, multivariable analysis demonstrated that water immersion was not independently associated with postpartum blood loss after adjustment for parity and baseline hemoglobin level. These findings support water immersion as a safe non-pharmacological option for labor management in low-risk women.

Ethics approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the

institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed patient consent was obtained.

Informed consent

Informed consent was obtained from all participants included in the study.

Conflict of interest

None declared.

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