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Original Research Article

A Prospective and Clinical Study of Post-Partum Blood Loss in Induced Versus Spontaneous Vaginal Delivery

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Abstract:

Background: The diagnosis and treatment of postpartum hemorrhage (PPH), a dangerous obstetric complication, depend heavily on real-time blood loss measurement. Predelivery and postdelivery blood hemoglobin and hematocrit measurements are used to evaluate postpartum blood loss in vaginal births. This study compares third stage blood loss in vaginal deliveries that are induced vs those that occur spontaneously and it looks at the relationship between blood loss and the drop in hemoglobin after delivery.

Methods: From January 2023 to September 2023, the current prospective and clinical study was carried out in the obstetrics and gynecology department of the Madhubani Medical College and Hospital in Madhubani, Bihar. Using specialized collecting bags, blood loss after placental births was assessed in 150 pregnant women who delivered vaginally via labor induction, and the results were compared to those of another 50 women who delivered vaginally on their own. Prior to labor and following childbirth, each patient's hemoglobin levels were documented.

Results: The spontaneous group had a mean blood loss of 172 ± 114 mL, while the induced group had a mean blood loss of 30 mL less (p=0.12). However, this difference was not statistically significant. Comparing the oxytocin group's blood loss (327 ± 140 mL) to other labor induction types and spontaneous deliveries, however, revealed a considerably greater blood loss due to the diverse induction techniques used. In comparison to spontaneous deliveries, prostaglandin-assisted labor induction did not result in increased blood loss. Post-delivery hemoglobin values in both the induced and spontaneous delivery groups showed statistically significant drops; however, the induced group's drop was comparatively greater than the spontaneous vaginal delivery group's (0.96gm/dL vs. 0.56gm/dL), which also appeared to be statistically significant (p=0.001).

Conclusion: Using prostaglandins for labor induction is safer than using oxytocin. For all deliveries, it is crucial to accurately estimate blood loss in order to identify postpartum hemorrhage early and take the necessary action.

Keywords: Third stage blood loss, Postpartum haemorrhage, Labour induction, Oxytocin, Prostaglandins.

Introduction

Within 24 hours of giving birth, postpartum hemorrhage (PPH) is defined as a blood loss from the vaginal tract of at least 500–1000 ml along with hypovolemia symptoms or indicators [1, 2]. It is linked to significant rates of death and morbidity and is the most prevalent type of serious obstetric hemorrhage. Preventive actions are advised as a history of PPH is a risk factor for PPH in subsequent pregnancies1. Therefore, the diagnosis of PPH ought to be as precise as feasible. Nevertheless, the definition and monitoring of PPH rely on subjective gross estimations of blood loss, which are frequently inaccurate and have a tendency to underestimate blood loss, hence postponing diagnosis [3-6]. In one study, nearly 20% of women with severe PPH defined as meeting at least one of the following criteria were diagnosed based only on laboratory results [7]. These women included those who had undergone hysterectomy, arterial embolization, and conservative surgery for PPH, hemoglobin (Hb) decreases by more than 4 g/dl, transfer to an intensive care unit, and death attributed to PPH. In theory, a decrease in hemoglobin could offer a quantifiable indicator for the diagnosis of PPH. In fact, a complete blood count (CBC) is typically carried out for baseline measurements during PPH occurrences. Guidelines for normal and abnormal Hb decrease ranges and durations following delivery, however, are still elusive. Research that reported on these parameters looked at treatments or other indicators for overt PPH; women without

PPH or with hypovolemia-related symptoms (occult PPH) but no overt bleeding were not included.

Material and Methods

From January to September of 2023, the Department of Obstetrics and Gynecology at Madhubani Medical College and Hospital in Madhubani, Bihar, carried out this non-interventional, prospective, and clinical observation based study. 200 pregnant women made up the study population; 50 of them gave birth spontaneously while the other 150 underwent vaginal deliveries following labor induction. The study excluded patients who were receiving heparin medication or had a history of bleeding issues.

Every woman was asked to provide a thorough history, and they were all given general physical examinations. Preeclampsia, pregnant hypertension, gestational diabetes mellitus, and a prior history of postpartum hemorrhage were among the risk factors that were appropriately identified. Before the induction, the patients gave their written, informed consent. The obstetrician who was caring for the patient chose the kind of induction. The following induction protocols were part of the study.

1. Artificial Rupture of Membranes (ARM) which was supplemented with oxytocin.
2. Preinduction priming with Mifepristone, followed by intracervical dinoprostone gel (Cerviprime).
3. Intracervical Cerviprime only.
4. Oral dinoprostone tablets (Primiprost).

Using a blood collection bag that was specifically made for the purpose, the amount of blood lost throughout the third stage of labor was tracked. Each patient's hemoglobin levels were noted at the beginning of labor and on the first postpartum day. Furthermore documented were the mother's age, parity index, and gestational age, length of labor, induction method, and indication for induction. Upon placental ejection, all patients—induced or not—got an injection of Methergine 0.2 mg IM, and those with hypertension also received an injection. Prostodin 250 IU intramuscularly. The baby's weight, any related difficulties, and the APGAR readings at five and ten minutes were all appropriately documented.

The SPSS statistical software (version 14 for Windows) was used to conduct the statistical analysis. ANOVA was used to compare variations within induced groups, paired t-tests were used for paired observations (haemoglobin changes before and after delivery), independent t-tests were used to compare blood loss between induced and spontaneous delivery groups, and Chi-square ($\chi 2$) test was used to compare cases and controls for cross-tab data. At a p-value of 0.05, the difference was considered statistically significant.

Results

Over a period of six months, 200 patients were examined; 150 of them underwent vaginal births after labor induction, while the remaining 50 gave birth on their own. Age, height, weight at delivery, and parity index were all well matched between the two groups [Table -1].

Table 1: Demographic characteristics of study and control groups a. independent t-test, b. chi sq. tests

Variables	Induced (n=150)	Spontaneous (n=50)	p-value
Maternal Age (yrs.)	26.4±3.87	27.2±3.80	0.22a
Height (mtr.)	1.543±0.04	1.548±0.05	0.54a
Weight before delivery(kg)	62.23±8.06	64.29±10.04	0.61a
BMI	27.4±3.24	26.8±4.15	0.45a
Parity			
• Nullipara	89(59%)	25(50%)	
• Primipara	52(35%)	23(46%)	
• Multipara	9(6%)	2(4%)	0.34b
Antenatal Complications			
• Preeclampsia	36(24%)	3(6%)	0.001b
• Gestational Hypertension	12(8%)	1(2%)	0.13b
- Essential Hypertension	9(6%)	Nil	0.07b
- Gestational Hypertension	24(16%)	4(8%)	0.15b
• IUGR	18(12%)	2(4%)	0.10b
• Oligoamnios	15(10%)	2(4%)	0.18b
• PROM	27(18%)	3(6%)	0.03b
• Past Dates	9(6%)	Nil	0.07b
Gestational age at labour (wks)	37.1±1.75	38.2±1.91	<0.01a
Duration of labour (hrs)	6hr56min±2hr34min	5hr28min±2hr24min	0.002a
Hb before delivery (gm/dL)	12.01±0.86	12.19±1.27	0.39a
Birth Weight (kg)	2.853±0.386	2.901±0.430	0.55a

Preeclampsia was statistically more common in the induced group; this finding may be attributed to the group's regular induction of labor by 38 weeks of gestation.

Similarly, the induced group had a higher frequency of prelabour rupture of the membranes because the condition needed delivery in the event that the patient did not go into spontaneous labor. Due to several problems requiring delivery by 37 full weeks, the induced group's gestational age at birth was much lower. Additionally, the induced group's labor was considerably longer (6 hours 56 minutes compared to 5 hours 28 minutes). The two groups' birth weights and hemoglobin levels did not differ significantly.

The techniques and medications used to induce labor are listed in Table 2-2. In order to induce labor in 31 patients, we used two different surgical techniques: artificial rupture of membranes (ARM) when the cervix was favorable and 3 cm dilated, followed by continuous oxytocin infusion in accordance with conventional protocols.

In 59 cases, intracervical dinoprostone E2 gel was used to ripen the cervix when the Bishop score was low. In some cases, this process was repeated every eight hours until a suitable reaction was achieved. Preinduction cervical preparation was administered to forty patients orally using 200 mg of mifepristone, and intracervical cerivime was administered 24 hours later.

When there was a frank leak, oral primiprost (PGE2-dinoprostone) was administered because intracervical cerviprime was likely to be ejected due to alcohol spurting out of the vagina.

Table 2: Methods of induction

Artificial Rupture of membranes (ARM) followed by Oxytocin intravenous infusion	31
Intracervicaldinoprosione E2 gel (Cerviprime)	59
Oral Mifepristone followed by intracervicaldinoprostone gel	40
Oral dinoprostone (PGE2) tablets (Primiprost)	20
Total	150

The analysis of third stage blood loss (means and standard deviations) for the two main groups and the induced group subgroups is presented in Table - 3.Compared to the spontaneous group, the induced group experienced a mean blood loss of about 30 mL more.

Nevertheless, this difference was not statistically significant (p value of 0.12 was found using independent t-test statistics). Compared to other induction techniques, artificial rupture of the membranes (ARM) followed by oxytocin resulted in a greater amount of blood loss among the induced group. One way analysis of variance, or ANOVA, was used to find variance within the induction group. Significant differences in blood loss were seen in the test [Table -4] both across and within the various induction groups (f-value: 20.8, p-value <0.001).

Table 3: Third stage blood loss in various groups in mL

Numbers	Mean	Std. Dev.
According to the type of delivery		
Induced delivery	202	117
Spontaneous delivery	172	114
According to the method of induction		
ARM and oxytocin	327	140
Cerviprime	173	99
Mifeprostone and Cerviprime	165	64
Primiprost	166	70

Table 4: One way analysis of variance (ANOVA) of blood loss variation

	Sum of Squares	Df	Mean square	f	Sig.
Between groups	611930.175	3	203976.725	20.829	0.0001
Within groups	1429740.659	146	9792.744		
Total	2041670.833	149			

Several induction procedures were compared pairwise using Tukey's post hoc tests. It was discovered that, in comparison to the other groups, the ARM and oxytocin group had much more blood loss. Blood loss was similar and decreased across prostaglandin types, with no statistically significant differences seen. The statistical findings are displayed in [Table -5].

Table 5: ANOVA Post-hoc Statistics (Tukey's test)

Induction of protocols	Number	Different (p<0.05) from
ARM and Oxytocin	31	Cerviprime Mifeprostone with Cerviprime Primiprost
Cerviprime	59	ARM & Oxytocin
Mifeprostone & Cerviprime	40	ARM & Oxytocin
Primiprost	20	ARM & Oxytocin

In order to identify which induction technique was linked to greater blood loss when compared to spontaneous births, additional analysis was conducted to compare the blood loss in the four induction procedure groups with that in the spontaneous delivery group. The outcomes of separate t-tests are displayed in [Table -6]. Comparatively speaking, the oxytocin group lost more blood than the spontaneous group. Blood loss with prostaglandin-assisted labour induction was not greater than that of spontaneous deliveries.

Table 6: Third stage blood loss in various induction protocols compared to spontaneous deliveries

Type of induction (n)	Control (n)	p-value
ARM & Oxytocin (31)	Spontaneous (50)	<0.0001
Cerviprime (59)	Spontaneous (50)	0.94
Mifeprostone & Cerviprime (40)	Spontaneous (50)	0.74
Primiprost (20)	Spontaneous (50)	0.83

Table 7 presents variations in haemoglobin levels prior to delivery and in the first 24 hours after giving birth.

The haemoglobin levels in the induced and spontaneous delivery groups both showed a statistically significant decline, but the induced group's decline was comparatively greater than that of the spontaneous vaginal delivery group (0.96 gm/dL vs. 0.56 gm/dL), and this difference was statistically significant (p=0.001). Within the induced group, five incidences of postpartum haemorrhage (defined as blood loss greater than 500 mL) were observed. All five cases responded to conservative care; none required surgery, with four occurring in the oxytocin group and one in the cerviprime-induced birth group. In the group of spontaneous vaginal deliveries, there were no such cases.

Table 7: Changes in the hemoglobin after delivery

	Hemoglobin before delivery		Hemoglobin after delivery		Significance
	Mean	Std. Dev.	Mean	Std. Dev.	p-value*
Induced Delivery (n=150)	12.01	0.86	11.05	1.19	0.001
Spontaneous Delivery (n=50)	12.19	1.27	11.63	1.21	0.001

Discussion

According to WHO data, hemorrhage accounted for over 30% of reported maternal deaths in developing countries, with hypertensive disorders ranking among the top causes of maternal mortality. Due to the rising number of births made after labor inductions, a thorough investigation into the purportedly elevated risk of postpartum hemorrhage linked to induced labor has become imperative. Research indicates that between 1989 and 1997, the number of inductions performed almost doubled. Current research indicates that between 9.5 and 33.7% of pregnancies result in labor induction each year. Third stage blood loss is typically thought to be higher in individuals whose labor is stimulated with oxytocin induction or augmentation than in patients whose delivery occurs spontaneously. This is due to the fact that sometimes the uterus, which contracts during the early stages of labor due to the hormone oxytocin, stops contracting after the baby is delivered and the placenta is expelled. Another commonly cited rationale is the higher rate of premature labor in these women due to their careless oxytocin use; however, this was not observed in our study because we were extremely cautious while using oxytocin. Prostaglandins, on the other hand, are more frequently employed these days because they are superior to oxytocin induction in that they can generate structural changes in the cervix, which facilitates easier dilation during the early stage of labor. An additional benefit is that there are numerous equivalents available and they can be utilized by various pathways [9]. Prostaglandin-induced labor induction has been linked in numerous studies to a reduction in third-stage blood loss [10].

While numerous studies have examined the prevalence of primary postpartum hemorrhage in different forms of labor inductions, there is a dearth of evidence in the literature about the precise amount of blood loss that transpires during the third stage of labor. Blood losses were higher in the oxytocin-administered group (333 ± 298 mL)

compared to the control group (345 ± 285 mL) in a prior American study [11]. The mean blood loss for vaginal deliveries that occurred spontaneously was 205 mL, but for induced deliveries it was 235 mL, according to Brinsden and Clark of St Mary's Hospital in Portsmouth, Hampshire12. The oxytocin group in our study lost a similar amount of blood (334 ± 147 mL), however the control group lost less blood (172 ± 114 mL). This might be related to the present approach of actively managing third-stage labor in order to limit the volume of blood loss.

A study on blood loss during misoprostol induction was conducted in Jamaica (2013). When comparing all cases of induced labor to those without, the mean blood loss during delivery was noticeably higher. The lowest mean blood loss (100 ± 130 mL) was observed in the control group when no predelivery oxytocin was required for misoprostol (162.5 ± 190 mL), oxytocin (150 ± 100 mL), and misoprostol plus oxytocin (150 ± 150 mL). We oppose the use of misoprostol in third trimester labor induction due to additional negative consequences linked to its induction. [13]

The incidence of postpartum hemorrhage, which was defined as a blood loss of more exceeding 500 mL, was the primary focus of several research conducted on the use of dinoprostone (PGE2) for labor induction by various ways. However, the amount of third stage blood loss was not included in these studies. Prostaglandin induction was not linked to a higher risk of postpartum hemorrhage compared to controls, according to Howarth GR and Botha DJ Cochrane meta-analysis review [14]. The current study also showed that, in contrast to women who delivered spontaneously, prostaglandin induction either by mouth or vaginal route was not linked to higher blood loss.

The current investigation did not reveal any appreciable decreases in hemoglobin levels in the groups that underwent induced and spontaneous delivery (12.01±0.86 gm/dL to 11.05±1.19 gm/dL, 12.19± 1.27 to 11.63±1.21 gm/dL). This could be because neither group's third-stage blood loss amount showed a statistically significant difference in the current study. When Bhullar A et al. compared the hemoglobin levels of the normal population to those in the buccal misoprostol group, they found that unless postpartum hemorrhage occurred first, there was no significant hemoglobin decline after delivery [15]. Numerous research on the calculation of third stage blood loss relied on ocular estimates of blood loss during placental delivery, which might often be 25–50% understated. [16] A prospective study was carried out at Singapore's National University Hospital by Razvi K et al. They contrasted the laboratory measurement of Measured Blood Loss (MBL) with the ocular Estimation of Blood Loss (EBL) at delivery. Underestimating blood loss was common when MBL was between 301 and 500 mL [17].

Patel et al. conducted a randomized controlled trial involving 123 women who gave birth at District Hospital, Belgaum, Karnataka, India. The results showed that the visual estimate of blood loss was 33% lower than the drape estimate. It was suggested that drape estimation of blood loss could be especially useful in underdeveloped countries because it was more accurate than ocular estimation. A blood collection bag with a calibrated collection pouch, akin to the BRASS-V drape used in the Belgaum trial, was employed in our investigation. In our investigation, we discovered that this method was quite helpful for precisely estimating blood loss. The diagnosis of acute postpartum hemorrhage, which can occur in circumstances like anemia and preeclampsia, and the prompt and proper implementation of intervention measures are the potential benefits of this form of calculation of blood loss [18].

Conclusion

Although parturition is now comparatively safer because to modern labor induction techniques that use prostaglandins, oxytocin is still occasionally necessary, particularly when labor augmentation is needed. But postpartum hemorrhages can happen with any kind of delivery, vaginal or induced, oxytocin or prostaglandin induced, and it is critical to identify them as soon as possible to reduce the associated morbidity and mother death. In this regard, accurate blood loss assessment is crucial. It has been shown that visual estimates understate the actual amount of blood lost and are subject to observer bias. The blood collection method described in this study is precise, user-friendly, and reasonably priced (less than Rs. 100 for each sterilized bag). Additionally, it enables the early detection of postpartum hemorrhage, particularly in situations such as anemia and preeclampsia, where even a tiny amount of blood loss is linked to dire consequences.

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