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Original Research Article

To Compare the Efficacy and Safety of Umbilical Vein Oxytocin Infusion and Intramuscular Oxytocin Administration in Management of Third Stage of Labour

Richa Sharma[1], Supriya Gupta[2], Ritu Bassi[3]

[1]Senior Resident, Department of Obstetrics & Gynaecology, Hindu Rao Hospital, Delhi, India
[2]Medical Officer, Department of Obstetrics & Gynaecology, Govt. Multispeciality Hospital, Chandigarh, India
[3]Medical Officer, Department of Obstetrics & Gynaecology, Govt. Multispeciality Hospital, Chandigarh, India

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Corresponding author: Dr. Richa Sharma
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Abstract:

Background: Postpartum hemorrhage (PPH) is a leading cause of maternal mortality globally, particularly in resource-limited settings. The third stage of labor, encompassing the delivery of the placenta, is a critical period for managing PPH. Oxytocin, a commonly used uterotonic drug, plays a pivotal role in preventing PPH. However, optimal dosages and administration routes for oxytocin remain uncertain. Intraumbilical vein oxytocin injection has emerged as a potential noninvasive method for reducing blood loss and addressing complications like retained placenta. This study aims to evaluate the efficacy and safety of intraumbilical vein oxytocin injection in shortening the third stage of labor and preventing excessive bleeding.

Methods: This prospective randomized case-control study involved 220 pregnant women in labor admitted to the Department of Obstetrics and Gynecology at the Government Multispecialty Hospital. Participants meeting specific criteria were allocated to either Group I or Group II using sealed opaque envelopes. Group I received 10 IU of oxytocin diluted in 18 ml of normal saline via the umbilical vein, while Group II received 10 IU of oxytocin intramuscularly at the delivery of the baby's anterior shoulder. Exclusion criteria were applied to certain medical conditions. Vaginal delivery was conducted, and blood loss was measured using a kidney tray and pre-weighted pads. Pulse rate, blood pressure, temperature, and side effects were recorded. The primary outcomes assessed were blood loss, incidence of PPH, duration of the third stage of labor, and manual removal of the placenta. Statistical analysis was performed using appropriate tests and software.

Results: The age distribution, gestational age, gravida, and parity were similar between Group I and Group II. The duration of the third stage of labor showed no significant differences between the two groups, with the most common duration being 5 minutes. The mean duration was 4.57 minutes in Group I and 5.082 minutes in Group II. Interventions and outcomes related to delivery, including episiotomy, tears, intact perineum, mode of placental delivery, and blood loss, were comparable between the groups. There were no cases of severe blood loss (PPH) in either group. These findings indicate similar outcomes in terms of delivery measures and associated interventions.

Conclusion: From these observations, it was concluded that intraumbilical oxytocin injection in the third stage of labor is comparable to intramuscular oxytocin injection in the active management of the third stage of labor. Intraumbilical vein oxytocin is considered safe, simple, inexpensive, and noninvasive. Therefore, it can be used as an alternative to the traditional method of intravenous oxytocin infusion in the management of the third stage of labor.

Keywords: Oxytocin, Labour, Umbilical vein, Intramuscular, Placenta.

Introduction

The third stage of labor refers to the period immediately following the delivery of the baby until the delivery of the placenta and membranes [1]. Postpartum hemorrhage (PPH) is the most common and feared complication during this stage, contributing significantly to maternal mortality, especially in Africa and Asia. Approximately 25% of maternal deaths worldwide are caused by PPH, resulting in over 100,000 deaths annually [2,3]. The death of mothers due to PPH has serious implications for newborns and surviving children. The failure of the uterus to contract and retract has

long been recognized as a major cause of PPH. Despite the availability of effective medical interventions, this condition remains a significant cause of maternal death, particularly in resource-limited countries where access to uterotonic drugs and high incidence of anemia complicate the third stage of labor [4].

Primary PPH is defined as excessive bleeding from the genital tract, exceeding 500 mL after vaginal delivery within 24 hours or over 1000 mL after cesarean delivery. However, the accuracy of measuring blood loss has led to challenges in defining PPH [5]. An alternative definition proposed by the American College of Obstetrics and Gynecology (ACOG) suggests labeling PPH based on a 10% fall in hemoglobin and/or hematocrit levels from before delivery to 24 hours after delivery, along with the need for blood transfusion [6].

Oxytocin, discovered in 1909 and widely used in clinical practice, plays a crucial role in labor induction, augmentation, and the management of the third stage of labor [7,8]. The dosage of oxytocin for PPH prophylaxis varies, with ranges of 2 to 10 IU for intravenous or intramuscular administration. Intravenous infusion provides an immediate effect, while the intramuscular route has a slower onset but a longer-lasting clinical effect [9].

In 1983, Golan proposed a method for placental separation and delivery by injecting a solution of oxytocin into the umbilical vein after clamping the cord [10,11]. This method showed advantages in reducing blood loss and managing complications like retained placenta [12,13]. However, some authors have found it unsatisfactory [14,15].

A newer, safer, noninvasive, practical, and effective method is needed to reduce the duration of the third stage of labor, prevent PPH and treat complications like retained placenta. Intraumbilical vein oxytocin injection has shown promising results in stimulating uterine contractions and reducing blood loss. However, there is limited published literature evaluating its routine use. Determining the ideal dosage and route of oxytocin administration for managing the third stage of labor, with maximum efficacy, safety, and minimal side effects, remains a challenge. The present study aims to evaluate the role of intraumbilical vein oxytocin injection and intramuscular oxytocin administration in reducing blood loss and shortening the duration of the third stage of labor.

Methods and Materials

Study Design

This study was carried out as a randomized case-control prospective study on 220 pregnant women in labor who were admitted to the labor room of the Department of Obstetrics and Gynecology at the Government Multispecialty Hospital, Sector-16, Chandigarh.

Allocation and Groups

The allocation of participants (Normal term (≥37 weeks) gestation with Singleton fetus with Cephalic presentation with Spontaneous onset of labor) was done using sealed opaque envelopes. Each patient was assigned to one of two groups: Group I: 110 patients who received 10 IU of oxytocin diluted in 18 ml of normal saline through the umbilical vein immediately after clamping and cutting the cord, proximal to the umbilical cord clamp. Group II: 110 patients who received 10 IU of oxytocin intramuscularly at the delivery of the anterior shoulder of the baby. Patients with Severe anemia (Hb<7.0 gm/dl), Antepartum hemorrhage, Chorioamnionitis, Hypertensive disorders, Multiple gestation, known coagulation disorder, Scarred uterus, Grand multiparity (>gravid 5), Systemic illness, Previous PPH, Polyhydramnios, Instrumental delivery, and Maternal age over 35 years were excluded from the study.

Procedure

Vaginal delivery was conducted, and oxytocin was administered according to the patient's assigned group. After delivery of the baby, the amniotic fluid was allowed to drain away. A kidney tray was placed against the perineum to measure blood loss. In cases where episiotomy was performed, the vagina was packed with a pre-weighted pad while suturing the episiotomy. The pad was weighed again after one hour. All gauges and pads were collected until one hour after delivery of the placenta, and their known dry weight was subtracted from the weight obtained after being soiled with blood. The total measured blood loss was calculated by adding this amount to the measured blood loss from the kidney tray. Pulse rate, blood pressure, and temperature were recorded at specific intervals. One hour after delivery, patients were asked to rate side effects using a visual analogue scale.

Outcome

The primary variables of interest included the amount of blood loss, incidence of PPH, duration of the third stage of labor, and manual removal of the placenta.

Statistical Analysis

Statistical analysis was performed using the Statistical Package for Social Sciences (SPSS Inc., Chicago, IL, version 18.0 for Windows).

Descriptive statistics were used to calculate means, medians, standard deviations, or standard errors, as appropriate. The normality of data was assessed using the Kolmogorov-Smirnov test. T-tests or

Mann-Whitney tests were used to compare means for normally or skewed distributed data, respectively.

Categorical variables were described as frequencies and proportions, and chi-square or Fisher's exact tests were used for comparisons. Statistical significance was set at a p-value of less than 0.05.

Results

The age distribution showed similar mean ages between Group I (24.33 years) and Group II (24.19 years). The distribution of gestational age, gravida, and parity was comparable between the two groups. Group I had higher percentages of participants in the age groups ≤20 years (24.6%) and 26-30 years (29.0%), while Group II had higher percentages in the age groups 21-25 years (87.1%) and 31-35 years (5.7%).

The proportions of primigravida and multigravida were 41.8% and 58.2% in Group I, and 49.1% and 50.9% in Group II, respectively. Parity distribution showed no significant differences (Table 1).

Table 1: Comparison of baseline characteristics of the patients in group I and II

Variables	Group I		Group II	
	Frequency	%	Frequency	%
Age group (in years)				
≤ 20	17	24.6%	14	20.0%
21-25	66	95.7%	61	87.1%
26-30	20	29.0%	31	44.3%
31-35	7	10.1%	4	5.7%
Mean age (in years)	24.33±3.607		24.19±3.661	
Mean POG (in weeks)	38.924±0.99		38.923±1.09	
Mean POG (in days)	272.47±6.95		272.46±7.63	
Gravida				
Primigravida	46	41.8%	54	49.1%
Multigravida	64	58.2%	56	50.9%
Parity				
P0	52	47.3%	57	51.8%
P1	46	41.8%	40	36.4%
P2	12	10.9%	13	11.8%

The duration of the third stage of labor was examined in both Group I and Group II. In Group I, the most common duration was 5 minutes (46.4%), followed by 4 minutes (31.8%) and 3 minutes (10.9%).

In Group II, the most common duration was also 5 minutes (51.8%), followed by 4 minutes (28.2%) and 3 minutes (13.6%). The mean duration of the third stage of labor was 4.57 minutes in Group I and 5.082 minutes in Group II.

These findings suggest that the duration of the third stage of labor is similar between the two groups, with a slight trend towards a longer duration in Group II. However, further analysis is needed to determine the clinical significance of these differences (Table 2).

Table 2: Comparison of 3rd stage of labour among the patients in group I and II

Variables	Group I		Group II	
	Frequency	%	Frequency	%
Duration of 3rd stage of labour (in minutes)				
3	12	10.9%	15	13.6%
4	35	31.8%	31	28.2%
5	51	46.4%	57	51.8%
6	12	10.9%	5	4.5%
>6	0	0.0%	2	1.8%
Mean Duration of 3rd stage of labour (in minutes)	4.57±0.829		5.08±4.513	

The interventions and outcomes related to delivery were compared between Group I and Group II. In terms of interventions, both groups had a similar distribution, with episiotomy being the most common intervention in both Group I (46.4%) and Group II (47.3%). The frequency of tears and intact perineum was also comparable between the groups. Regarding the mode of delivery of the placenta, complete cord traction (CCT) was the predominant method in both groups, with 100.0% in Group I and 98.2% in Group II. Manual removal of the placenta (MROP) was not required in Group I but was

performed in 1.8% of cases in Group II. The estimated blood loss was similar between the two groups, with the majority experiencing blood loss between 50-150 ml. The mean blood loss was 115.15 ml in Group I and 109.55 ml in Group II. There was no incidence of ≥ 500 ml blood loss (PPH) in both groups. These findings suggest that there were no significant differences in interventions, mode of placental delivery, and blood loss between the two groups, indicating comparable outcomes in terms of delivery and associated measures (Table 3).

Table 3: Comparison of maternal outcome post-delivery among the patients in group I and II

Variables	Group I		Group II	
	Frequency	%	Frequency	%
Intervention				
Episiotomy	51	46.4%	52	47.3%
Tear	11	10.0%	12	10.9%
Intact Perineum	48	43.6%	48	43.6%
Mode of Delivery of Placenta				
CCT (Complete Cord Traction)	110	100.0%	108	98.2%
MROP (Manual Removal of Placenta)	0	0.0%	2	1.8%
Estimated Blood loss (in ml)				
50-100	51	46.4%	58	52.7%
101-150	50	45.5%	46	41.8%
151-200	6	5.5%	6	5.5%
201-250	3	2.7%	0	0.0%
Mean blood Loss (in ml)	115.15±32.99		109.55±24.05	

Discussion

In various studies, the mean duration of the third stage of labor in the study group ranged from 1.48 to 5.9 minutes, with the present study reporting a mean duration of 4.57±0.829 minutes. In the control group, the mean duration ranged from 2.64 to 10.66 minutes, with the present study reporting a mean duration of 5.08±4.513 minutes[14-26].It can be observed that the mean duration of the third stage of labor in the study group tended to be shorter compared to the control group across multiple studies, including the present study. This suggests that the intervention or factor being studied in these studies may have contributed to a more efficient and quicker completion of the third stage of labor. However, it is important to note that there is variability in the reported durations among different studies, which could be attributed to various factors such as study population, methodology, and interventions utilized (Table 4).

Table 4: Duration of third stage of labour in various studies[14-26]

Study	Mean duration of third stage of labour in minutes	
	Study Group	Control Group
Reddy et al., [13]	4.1	9.4
Raut et al., [16]	3.16±1.53	4.16±3.79
Gungorduk et al., [17]	4.5±1.6	7.9±3.4
Nankali et al., [18]	4.24±3.27	10.66±7.41
Abdollahi et al., [19]	1.81±0.96	2.64±1.2
Karim et al., [20]	2.47±0.24	3.58±0.35
Shrestha et al., [21]	5.42	6.02
Fehmida et al., [22]	2.59	7.67
Ghulmiyyah et al., [23]	5.9±2.6	7.8±6.1
Ojha et al., [24]	3.6	3.7
Dahiya et al., [25]	1.48	3.27
Kore et al., [26]	5.6±3.2	10.2±2.8
Present study	4.57±0.829	5.08±4.513

In this study, only two women in the control group who received intramuscular oxytocin had a prolonged third stage of labor (>30 minutes). Manual removal of the placenta (MROP) was attempted when the third stage duration exceeded 30 minutes. Two women in the intramuscular oxytocin group required manual removal of the placenta, while no such intervention was needed in the intraumbilical vein oxytocin group. This finding is consistent with a study by Kovavisarach E et al., which evaluated the effect of umbilical vein oxytocin injection on the third stage of labor [27].

In their study, manual placental removal was performed in only one case in the control group, and no MROP was required in the study group. In the study by Raut et al., the incidence of retained placenta was 2% in the study group (intraumbilical oxytocin group) and 4% in the control group (intravenous methergin group) [16]. In various studies, the mean blood loss in the study group ranged from 85.31 ml to 242 ml, and mean blood loss in the the control groupranged from 98.4 ml to 373 ml[13,16,17,20,21,22,24,26]. In the present study, the mean blood loss was 115.15 ml ± 32.99 ml in the study group and 109.55 ml ± 24.05 ml in the control group. The difference in mean blood loss between the two groups is small and not statistically significant. Overall, the results indicate variability in mean blood loss between different studies, with some studies showing a potential benefit of the intervention in reducing blood loss, while others show minimal differences between the study and control groups (Table 5).

Table 5: Mean blood loss in various studies[13,16,17,20,21,22,24,26]

Study	Mean blood loss in ml	
	Study Group	Control Group
Reddy et al., [13]	135	373
Raut et al., [16]	135.68±149.76	101.59±139.51
Gungorduk et al., [17]	195±81.0	288.3±134.1
Karim et al., [20]	85.31±10.05	98.40±9.04
Shrestha et al., [21]	151.43	143.30
Fehmida et al., [22]	234.03	276.51
Ojha et al., [24]	242	168
Kore et al., [26]	125±30	275±55
Present Study	115.15±32.99	109.55±24.05

Limitations

The limitations of our study were the relatively small sample size and exclusion of high-risk cases for post-partum haemorrhage so the larger studies involving high risk cases are required for routine use of intraumbilical vein oxytocin injection in active management of third stage of labour.

Conclusion

From these observations, it was concluded that intraumbilical oxytocin injection in the third stage of labor is comparable to intramuscular oxytocin injection in the active management of the third stage of labor. Intraumbilical vein oxytocin is considered safe, simple, inexpensive, and noninvasive. Therefore, it can be used as an alternative to the traditional method of intravenous oxytocin infusion in the management of the third stage of labor. This alternative method is particularly useful in conditions where intravenous fluids need to be restricted due to concerns about pulmonary overload or in peripheral health centers where intravenous access may not be readily available for all delivering patients.Implementing this method not only avoids the adverse systemic effects associated with parenterally administered oxytocic agents but also relieves the obstetrician and midwife from the anxiety and dependence on the availability of an additional person during delivery and the proper timing of the injection by that person.

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