Original Article

Maternal haemodynamic effects of oxytocin bolus or infusion in the third stage of labour

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ABSTRACT

Objectives: The safety of bolus oxytocin has been questioned due to reports of maternal hemodynamic consequences. This study compared maternal haemodynamic effects of oxytocin bolus or infusion in the third stage of vaginal delivery.

Methodology: This was a randomized double-blind clinical trial in 170 women who received (10IU) intravenous oxytocin bolus or infusion in third stage of labour. Mean arterial pressure (MAP) and heart rate (HR) were measured before delivery and 1, 5, 10, 20 minutes after administration of oxytocin. These serial measurements and postpartum outcome were compared in two groups. Results were analyzed using analysis of variance for repeated measures, t-test, Man U Whitney, Fisher exact test, and chi-square test.

***Results*:** Findings showed MAP and HR did not vary between two groups (p= 0.38 and p= 0.65 respectively. Length of the third stage of labour, retained placenta and reduction in haemoglobin concentration for the bolus group was less than infusion group (p=0.000, p=0.042 and P=0.036 respectively). Other postpartum outcome was similar in two groups.

***Conclusion*:** Bolus oxytocin is not associated with adverse maternal hemodynamics and appeared to be as effective and can safely be administered in the third stage of labour.

KEY WORDS: Maternal Hemodynamics, Oxytocin, Third stage of delivery.

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INTRODUCTION

Postpartum Haemorrhage (PPH) is a significant contributor to maternal morbidity and mortality throughout the world and remains one of the leading cause of death in underdeveloped countries.[1,2] It is a well recognized complication of third stage of labour and since last two decades or may be more, the active management of third stage of labour with diligent attention is the accepted protocol to guard against it. The value of using routine oxytocins in bolus form has been well established. Diluted infusions may follow the bolus therapy in cases with prolonged labour or when considered necessary. The majority of the deaths occur in third stage of labour (TSL). A reasonable estimate is 5 percent of deliveries.[3-4] The most common definition of PPH is estimated blood loss e"500 mL after vaginal birth.[5] In most cases, uterine atony is the most common etiology.[6]

Active management of the TSL plays a large role such as uterine massage, and use of a medication to effect uterine contractions.[7] Current strategies for PPH include the prophylactic use of uterotonic. The value of routine oxytocics has been well established.[8]

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Oxytocin use is advocated either intramuscularly (10 IU) or as a dilute infusion (20 to 40 IU in 1000 mL), but administration of Intravenous bolus might cause a decrease in PPH remarkably. Intravenous bolus (1 to 10 units) has also been used by other authors and they showed it was associated with significant reduction in mean total blood loss and frequencies of PPH.[9,10] An IV bolus of oxytocin, 5 to 10 IU, can be used for PPH prevention after vaginal birth but is not recommended at this time with elective Caesarean section.[8]

Some studies have reported rapid bolus injection of oxytocin results in vasodilatation of arteries and leading to a fall in blood pressure and increase in heart rate.[11,12] In contrast other studies showed bolus oxytocin is not associated with adverse hemodynamic responses and can safely be administered to women in the TSL for PPH prophylaxis.[13,14] In most of the studies understanding the hemodynamic effects of oxytocin is complicated by the women undergoing termination of pregnancy in the first trimester, pre-eclamptic women and caesarian section.

Since bolus oxytocin is most likely more effective than infusion in decreasing the PPH, this study was designed to compare the effect of oxytocin bolus versus infusion on maternal hemodynamics and delivery outcome in the TSL in patients undergoing vaginal delivery without anesthesia.

METHODOLOGY

This clinical trial was carried out on women referred to Shabih Khani Maternity Hospital for vaginal delivery during 2008. Women were approached for participation in the study and informed consent was obtained. Inclusion criteria were vaginal delivery after 34 weeks, parity <5, Iranian nationality, singleton pregnancy. Exclusion criteria were history of PPH, precipitated delivery, preeclampsia, placenta previa/abruption, polyhydramnios, hypertension, & diabetes mellitus. Also women were excluded if there was cardiovascular instability & under anesthetic.

The protocol was approved by the Kashan University of Medical Sciences Research Board and approval from the local Ethics Committee was obtained. Immediately after delivery, and before delivery of the placenta, 170 participants received randomly oxytocin either as a bolus or a dilute infusion in a double-blind technique. Each group of subjects received one of the active interventions and a placebo. The bolus oxytocin group (n=85) received 10 IU of oxytocin as an intravenous push (with an equal volume of saline injected into 500 mL of normal saline and infused at 125 mL/h as the placebo). The oxytocin infusion group (n=85) received 10 IU of oxytocin in 500 mL of normal saline at 125 mL/h (with an equal volume of saline intravenous push as the placebo), oxytocin was administered by a doctor not involved in the care of the patient or any data recordings.

A baseline (time 0) blood pressure and HR were obtained between contractions during second stage of labour. At 1, 5, 10, and 20 minutes after the administration of oxytocin, their blood pressure and HR were measured. Also, postpartum outcome (duration of the TSL, placental retention (> 30 minute), using additional uterotonic agents, Hb 6 hours after delivery were recorded. Serial MAP, HR and postpartum outcome compared between two groups and were analyzed by repeated-measures analysis of variance. Continuous variables were analyzed by t test and Man U Whitney, categorical variables were analyzed by x2 and Fisher exact test. Statistical significance was set at $P < 0.05$. Data were analysed using SPSS 16 for windows.

RESULTS

Our findings revealed no statistically significant difference between two groups in baseline and intrapartum Characteristics (Table-I). Results showed the serial MAP in both groups was not significantly different either (Table-II), interaction between two groups (P=0.38). A decrease in MAP occurred at one minute after delivery in two groups up to [mean (SD)]

Table-I: Baseline and interapartum characteristics in the two groups.

Characteristic	*Bolus (n=85)*	*infusion(n=85)*	*P value*
Maternal age	26.56 ±5.6	27.92 ± 6.1	0.67
Gestational age	39.06 ±1.9	39.14± 1.2	0.74
Parity	1.68 ± .86	1.68 ± .9	1
Oxytocin in labour	54 (60)	53 (58.9)	0.87
Second stage of labour	20.49± 12.57	22.38±14.55	0.36
Baseline MAP	92.68 ± 7.9	91.44±7.4	0.29
Baseline HR	79.96± 8.2	78.97 ±8.9	0.45
Hemoglobin admission	13.30± 1.9	13.42± .84	0.38
Birth weight	3280± 459	3384 ±371	0.30

Data are given as mean (SD) or numbers (percent). Mean were analyzed by t tests, Man U Whitney and rates by X^2 test

Table-II: Changes in Mean Arterial Pressure (MAP) and Heart Rate (HR) after administration oxytocin in the two groups.

Characteristic	*Bolus (n=85)*	*Infusion (n=85)*
MAP in 1 minute	89.89 ±8.7	89.38±8.4
MAP in 5 minute	88.44± 7.4	87.12±8.2
MAP in 10 minute	87.57± 7.9	86.29± 7.2
MAP in 20 minute	87.94± 7.01	86.59± 7.8
HR in 1 minute	86.17±9.9	84.32±10.5
HR in 5 minute	82.03± 7.3	82.64±7.9
HR in 10 minute	80.35± 8.1	79.89±7.2
HR in 20 minute	78.98± 8.4	79.70±8.1

MAP and HR were analyzed by analysis of variance (ANOVA) for repeated-measures. Interaction effect for MAP (P=0.38) and for HR (P=0.65)

4.83 (9.8) mm Hg at 10 min in the bolus group and up to 5.3(8.8) mm Hg in the infusion group. Also mean HR in two groups did not vary significantly, interaction between two groups (P=0.65). An increase in HR of up to [mean (SD)] 6.21 (12.20) and 5.35 (10.76) beats per minute was seen in the bolus and infusion groups respectively (Table-II). Heart rate for two group remained stable and then decreased marginally between 10 and 20 minutes.

Postpartum outcomes in two groups are shown in (Table-III). Length of the TSL in the infusion group was more than bolus group significantly. Third stage of labour <5 minute in the bolus and infusion groups was 50% versus 13.3% respectively (P=0.0001), retained placenta was more in the infusion group (P=0.042). Hemoglobin concentration levels 6 hours after delivery and additional use of uterotonic drugs in two groups was similar but the average reduction in hemoglobin concentration for the bolus group was less than infusion group (P=0.036).

DISCUSSION

The findings demonstrated that use of bolus oxytocin did not result in the maternal hemodynamic changes in the selected about patients, but could decrease the length of the third stage of labour. One should be careful about the use of intravenous bolus oxytocin, it's safety has been questioned due to reports of maternal hemodynamic consequences. Thomas and colleagues.[15] Recruited 30 women undergoing elective Caesarean section. They were randomly allocated to receive 5 u of oxytocin either as a bolus injection or an infusion. They found a marked cardiovascular changes in the bolus; decreased in MAP and increased in HR.

Sartain et al[16] compared the effects of two doses of oxytocin two or five units in forty patients in each group undergoing elective Caesarean section. There was a greater increase in HR and decrease in MAP from baseline at one minute in patients who received 5 u of oxytocin. Pinder et al[12] studied the haemodynamic effects of boluses of oxytocin, 5 and 10 u, in 34 women having Caesarean section under spinal anesthesia. The dose-related effects of oxytocin were again confirmed. Secher and colleagues[11] studied only 9 pregnant anaesthetized women, they noticed that bolus oxytocin 10 units results in a fall in femoral arterial pressure by 40%, and lowers peripheral and pulmonary resistances by 59 and 44%, respectively within 30 seconds after administration. In these small studies the women who received anaesthesia, may not be generalizable to a postpartum population. Also Johnstone M[17] found fall in MAP was less in women placed in the lithotomy position, presumably due to improved venous returns. The difference in our findings, may be explained by the fact that most of our patients were in the lithotomy position, and none received anesthetic.

In contrast Davies and et al[13] reported serial MAP measures in bolus group was more than infusion group after one minute post administration of oxytocin and mean HR increased in two groups that was more than in bolus group only 6.6 beats per minute, heart rate for infusion group decreased marginally between 15 and 30 minutes and for bolus group stabilizing after 10 minutes. They showed bolus oxytocin of 10 IU is not associated with adverse hemodynamic responses in vaginal delivery. Sorbe[14] described using a 10 IU bolus of oxytocin in 506 women

Table-III: Postpartum outcome characteristics in the two groups.

Characteristics	*Bolus (n=85)*	*infusion(n=85)*	*P value*
Third stage of labor (min)	5. 01±2.0	7.3± 4.1	0.000
Third stage of labor <5 min	45(50)	12(13.3)	0.0001
Third stage of labor > 30 min	1(1.2)	6(7.1)	0.042
Additional oxytocin	6 (6.7)	7 (7.7)	0.77
Hb 6 hours post delivery	12.31± 1.1	12.03±1.0	0.1
*Change in hemoglobin (g/dL)	1.0± 1.1	1.38± 1.2	0.036

**Change in hemoglobin was calculated as admission hemoglobin minus postpartum hemoglobin.*

for postpartum hemorrhage prophylaxis. Although blood pressure was not recorded, no patients described symptoms or clinical signs of hypotension.

We found length TSL and retained placenta in the infusion group was more than bolus group significantly and average reduction in hemoglobin concentration levels for the bolus group was less than infusion group. The need for further uterotonics in two groups was similar. Davis and et al[13] described the oxytocin infusion group experienced a greater mean estimated blood loss, increased use of additional oxytocics and a greater drop in hemoglobin compared with the oxytocin bolus group. Thomas et al[15] found no differences between the bolus and infusion groups in blood loss, but in theirs study infusion oxytocin was administered after delivery given as 5 u diluted to 15 ml with normal saline given over 5 minutes that women in the infusion group were exposed to high oxytocin during observation. In summary this study supports using 10 IU oxytocin as a bolus is not associated with adverse hemodynamic effects and can safely be administered to women with vaginal delivery without anesthetics in the third stage of labor for placenta retention and post partum hemorrhage prophylaxis.

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