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ORIGINAL ARTICLE

Continuous Versus Intermittent Oxytocin Infusion Throughout the Active Phase of Labor: A Randomized Controlled Trial

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Abstract

Background: **Modern obstetric practice includes augmentation of labour, which leads to progressive cervicovaginal effacement and dilation, as well as childbirth. The use of several acceptable procedures has significantly improved induction's safety and reliability in recent years.**

Aim and objectives: **To contrast the effects of oxytocin infusions that are continuous with those that are intermittent during labor's active phase.**

Subjects: **and methods: 200 pregnant women participated in an interventional, randomised clinical research at El-Hussein University Hospital's Obstetrics and Gynecology Division. Two equal groups made up this study. Group (A): 100 pregnant women who had continuous oxytocin infusion labour induction made up this group. Group (B): For the purpose of inducing labour, 100 pregnant women in this group received oxytocin infusions on a sporadic basis.**

Results: **Regarding maternal age (years) or BMI, In the current investigation, there was no statistically significant difference between Group A and Group B. In this study, there was no statistically significant difference between Group A and Group B according to the Indication for Induction. The results of the present investigation demonstrated that there was no statistically significant difference between Group A and Group B in the pH of the umbilical artery. In this study, there was no statistically significant difference between Group A and Group B in terms of NICU admission, 1- or 5-min Apgar scores, or birth weight.**

Conclusion: **Total duration of oxytocin infusion and uterine hyperstimulation were higher in the continuous oxytocin infusion group. While the duration of active phase of labor seems equal in both groups.**

Keywords: Active phase of labor, Continuous oxytocin infusion, Intermittent oxytocin infusion

1. Introduction

Recent decades have seen an increase in induction of labour (IOL), with significant variance between countries and hospitals. A variety of techniques can be used to induce labour, but vaginal prostaglandins and cervical catheterization, additionally to oxytocin, artificial membrane rupture (ARM), and, are most frequently used (or ARM oxytocin only if the cervix is favorable).[1]

Standard for labour induction is oxytocin. By activating calcium channels controlled by receptors and releasing calcium from the sarcoplasmic reticulum, oxytocin induces uterine contraction. The expression of oxytocin receptor sensitivity determines the oxytocin's efficacy. When the number of oxytocin receptors in the myometrium rises above a certain level, an effective uterine contraction starts.[2]

Using oxytocin to induce labour may cause uterine atony, and prolonged labour induction may

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cause postpartum atony, in which bleeding cannot be stopped by giving oxytocin intravenously.[3]

Despite the fact that oxytocin is frequently used, there is no established strategy for its best application. Although oxytocin infusion is frequently utilised, there is still disagreement over whether it should be stopped before the active phase of labour or kept on until delivery. There have only been a few research done on the length of time oxytocin is administered during delivery.[4–6]

Oxytocin use during labour may have negative consequences on the mother, including tachycardia, arrhythmia, hypotension, headaches, flushing, and nausea. High doses of oxytocin can have adverse consequences, including hyponatremia, water retention, myocardial ischemia, convulsions, and coma, however, these are relatively rare.[7] A standardised and detailed approach is required to lower the rate of adverse maternal and foetal events brought on by incorrect or unneeded oxytocin treatment.[8]

A meta-analysis on this subject using seven randomised control trials RCTs was released in 2015. In contrast to women who continued to receive oxytocin (OC: oxytocin continuation) after entering the active phase, the study found that suppressing oxytocin (oxytocin discontinuation; OD) when the active labour phase was reached would reduce the risk of caesarean section, uterine hyper stimulation, and changes to the FHR but would not affect the length of labour overall.[9]

The study's goal was to compare between continuous versus intermittent oxytocin infusion throughout the active phase of labor and its outcome.

2. Patients and methods

Two hundred pregnant women participated in this interventional RCT trial at El-Hussein University Hospital's Obstetrics and Gynecology Division. After receiving approval from Al-Azhar University's Institutional Ethical Committee, the study was carried out. Before enrolling the parents in the study, informed consent was gained from them.

Inclusion criteria were all with indication for augmentation of labor for patients in active phase. Pregnant at 37 completed weeks or more. Cephalic presentation. Adequate pelvis. The period of labour during which the cervical cavity has dilated by at least 4 cm within 24 h of the start of induction.

Exclusion criteria were Cephalo-pelvicdis proportion. Pervious uterine surgery to augumentation by oxytocin Placental abnormalities (placentaprevia, placenta accrete). Estimated fetal weight >4.5 kg by ultrasound. Patient in spontaneous labor. Use of other inducing drugs like prostaglandins.

Two equally sized groups of women were created: Group (A): which consisted of 100 expectant women who subjected to labor induction by continuous oxytocin infusion. Group (B): that included 100 pregnant women who subjected to labor induction by intermittent oxytocin infusion.

All patients were subjected to full detailed history on admission: (age, residency, educational level, occupation, number of children, smoking), menstrual history (time of menarche, number of days, amount, irregularity, abnormal bleeding), (obstetric history (1st day of last menstrual period, estimated gestational age, expected day of delivery), any medications, previous operations, medical problems or any surgery involving the uterus, ovaries and adnexa). **Full detailed physical examination:** including (weight, length, body mass index, vital signs, head and neck, chest and heart, abdominal examination: fund allevel, tenderness, fetal movements, fetal heart sounds, pelvic examination: engagement, position, lie, cervix dilatation. Membrane intact). **Laboratory investigations:** Complete blood count. ABO. Random blood glucose. Urine-analysis and albumin in urine.

2.1. Pelvi-abdominal ultrasound

To induce labour in all of the pregnant women in group 1, oxytocin IV drip infusions were administered at a rate of 1 mIU/minute (5 IU of oxytocin were dissolved in 500 ml of 0.9% NaCl). Until consistent contractions started occurring at a rate of 3–5 per 10 min, the dose was raised by 1 mIU/min every 20 min. The maximum owed oxytocin flow rate is 20 mIU/min. At the start of the active phase, those with intact membranes underwent amniotomy. All pregnant women were monitored throughout the labor stages by measurements of blood pressure, pulse and temperature every hour. Auscultation of FHR was done by sonic aid and recorded in every stage. Intervention was stopped if there is suspicious or abnormal FHR or occurrence of uterine hypertonus. Vaginal examination was done every 1–2 h, and labor progress will be assessed by partogram.

For group 2, oxytocin IV drips were used to induce labour earlier in all of the expectant mothers. 5 IU of oxytocin were infused into 50 ml of glucose; the starting dose was 1–2 mU/min; the maximum dose was 20 mU/min; and the escalation rate was 1–2 mU/min every 30 min The maximum total owed oxytocin dose is 20 mIU/minute. At the start of the active phase, those with intact membranes

underwent amniotomy. All pregnant women were monitored throughout the labor stages by measurements of blood pressure, pulse and temperature every hour. Auscultation of FHR was done by sonic aid and recorded in every stage. Intervention was stopped if there is suspicious or abnormal FHR or occurrence of uterine hypertonus. Vaginal examination was done every 1–2 h, and labor progress will be assessed by partogram.

Primary outcome: Duration from the start of active phase of labor to delivery in the two groups and **secondary outcome:** Occurrence of complications, abnormalities in fetal heart rate during labor, need for assisted de livery, uterinehy pert onus, postpartum hemorrhage (Atonic or Traumatic), cervical tear, arrested progress of labor, neonatal low APGAR score at 5 min and need for NICU admission.

2.2. Sample size justification

Sample size calculation was done using the results of a recent study designed to detect the augmentation of labor via oxytocin use.[10] We calculated the effect size that was 0.848 (large effect size), alpha error was 0.05 and power of 0.95 was used. Accordingly, Using a priori analysis, the G*Power (3.1.9.4) software estimated the sample size.for difference between two independent means (two groups) independent sample t-test.

2.3. Statistical analysis

Software from IBM called SPSS 26 for Windows was utilised for the analysis. For numerical variables, descriptive statistics are reported as the mean and standard deviation, whereas percentages and numbers are used for categorical variables. The comparison between two groups with qualitative data were done by using Chi-square test and/or Fisher exact test was used instead of Chi-square test when the expected count in any cell was found less than 5. The comparison between two independent groups with quantitative data and parametric distribution was done by using Independent *t*-test.

Statistical significance was defined as a two-tailed *P* value 0.05.

3. Results

Comparison between Group A (no. = 100) and Group B (no. = 100) regarding Maternal age (years) and BMI. Table 1.

Comparison between Group A (no. = 100) and Group B (no. = 100) regarding Gestational age and Parity. Table 2.

Table 1. Comparison between Group A (no. = 100) and Group B (no. = 100) regarding Maternal age (years) and BMI.

	Group A No. = 100	Group B No. = 100	Test value	*P* value
Maternal age (years)				
Mean ± SD	26.61 ± 4.88	26.96 ± 4.64	−0.513•	0.609
Range	20–35	20–35		
BMI				
Mean ± SD	27.31 ± 6.65	28.58 ± 4.45	−1.588•	0.114
Range	15–39	20–35		

P-value >0.05: Nonsignificant (NS); *P*-value <0.05: Significant (S), *: Chi-square test, •: Independent *t*-test.

Comparison of birth weight, 1-min and 5-min Apgar scores, NICU hospitalisation, and umbilical artery pH between Group A ($n = 100$) and Group B ($n = 100$). Table 3.

Comparison of the Active Phase Duration (h), Total Oxytocin Infusion Duration (h), and Mode of Delivery between Group A ($n = 100$) and Group B ($n = 100$). Table 4.

Comparison between Group A (no. = 100) and Group B (no. = 100) regarding Abnormal fetal heart rate, Uterine hyper stimulation, Perineal tears, Instrumental vaginal delivery and Indications for cesarean delivery. Table 5.

4. Discussion

The most popular and frequently employed substance for labour induction and augmentation is oxytocin. Despite the fact that oxytocin is frequently used, there is no established strategy for its best application. Although oxytocin infusion is frequently utilised, there is still disagreement over whether it should be stopped before the active phase of labour or kept on until delivery. There have only been a few research done on the length of time oxytocin is administered during delivery.[6]

According to Morad et al.,[11] oligohydramnios, postdate, and premature rupture of the membranes (PROM) were indications for induction cases. The

Table 2. Comparison between Group A (no. = 100) and Group B (no. = 100) regarding Gestational age and Parity.

	Group A No. = 100	Group B No. = 100	Test value	*P* value
Gestational age				
Mean ± SD	39.88 ± 3.47	40.06 ± 3.31	−0.375•	0.708
Range	35–45	35–45		
Parity				
Multiparous	41 (41.0%)	45 (45.0%)	0.326*	0.568
Nulliparous	59 (59.0%)	55 (55.0%)		

P-value >0.05: Nonsignificant (NS); *P*-value <0.05: Significant (S), *: Chi-square test, •: Independent *t*-test.

Table 3. Comparison between Group A (no. = 100) and Group B (no. = 100) regarding Birth weight, 1-min Apgar score, 5-min Apgar score, NICU admission and Umbilical artery pH.

	Group A	Group B	Test value
	No. = 100	No. = 100	
Birth weight			
Mean ± SD	3228.62 ± 292.49	3171.28 ± 348.63	1.260•
Range	2750–3674	2640–3798	
1-min Apgar score			
Mean ± SD	7.76 ± 0.70	7.94 ± 0.65	−1.914•
Range	6.5–9	6.5–9	
5-min Apgar score			
Mean ± SD	8.94 ± 0.60	9.00 ± 0.54	−0.712•
Range	8–9.8	8–9.8	
NICU admission			
No	96 (96.0%)	98 (98.0%)	0.687*
Yes	4 (4.0%)	2 (2.0%)	
Umbilical artery pH			
≥7.1	97 (97.0%)	99 (99.0%)	1.020*
<7.1	3 (3.0%)	1 (1.0%)	

P-value >0.05: Nonsignificant (NS); *P*-value <0.05: Significant (S), *: Chi-square test, •: Independent *t*-test.

two groups did not differ much from one another, though. No statistically significant difference in birth weight or 1- or 5-min Apgar scores was found in this investigation., or NICU admission between Group A and Group B. In the similar vein, Morad et al.[12] observed that there were more frequent NICU admissions in the continuous group A than the discontinuous group B, but no statistically significant differences between the two groups for APGAR scores 7.0 at 5 min.

This result agreed with Hernandez-Martínez et al.[13] who showed no significant differences on the neonatal outcomes in the group with continued oxytocin infusion than the discontinued group.

Regarding the length of the active phase, In the current investigation, Between Group A and Group B, there was no statistically significant difference.

Table 4. Comparison between Group A (no. = 100) and Group B (no. = 100) regarding Duration of active phase (h), Total duration of oxytocin infusion (h) and Mode of delivery.

	Group A	Group B	Test value	*P*-value
	No. = 100	No. = 100		
Duration of active phase (h)				
Mean ± SD	9.57 ± 4.10	10.78 ± 3.68	−2.188•	0.057
Range	4.5–16	6–17		
Total duration of oxytocin infusion (h)				
Mean ± SD	15.71 ± 5.61	12.46 ± 4.47	4.526•	0.000
Range	6.5–25	6–21		
Mode of delivery				
Cesarean section	7 (7.0%)	3 (3.0%)	1.684*	0.194
Spontaneous vaginal delivery	93 (93.0%)	97 (97.0%)		

P-value >0.05: Nonsignificant (NS); *P*-value <0.05: Significant (S), *: Chi-square test, •: Independent *t*-test.

Table 5. Comparison between Group A (no. = 100) and Group B (no. = 100) regarding Abnormal fetal heart rate, Uterine hyper stimulation, Perineal tears, Instrumental vaginal delivery and Indications for cesarean delivery.

	Group A No. (%)	Group B No. (%)	Test value	*P*-value
Abnormal fetal heart rate				
No	97 (97.0%)	99 (99.0%)	1.020	0.312
Yes	3 (3.0%)	1 (1.0%)		
Uterine hyper stimulation				
No	79 (79.0%)	96 (96.0%)	13.211	0.000
Yes	21 (21.0%)	4 (4.0%)		
Perineal tears				
≥Grade 2	21 (21.0%)	25 (25.0%)	0.452	0.502
<Grade 2	79 (79.0%)	75 (75.0%)		
Instrumental vaginal delivery				
forceps	1 (1.0%)	4 (4.0%)		
None	98 (98.0%)	93 (93.0%)	2.931	0.231
Vacuum	1 (1.0%)	3 (3.0%)		
Indications for cesarean delivery				
Fetal distress	2 (2.0%)	0 (0.0%)	2.020	0.155
Failure to progress	5 (5.0%)	3 (3.0%)	0.521	0.470

P-value >0.05: Nonsignificant (NS); *P*-value <0.05: Significant (S), *: Chi-square test, •: Independent *t*-test.

While Morad et al.[12] showed that, the active phase of labour lasted 53 min longer in the case of primigravida and 75 min longer in the case of multigravida in the discontinuous group B compared to the continuous group A. Oxytocin withdrawal during the active period of labour may lead to better labour outcomes. In the study conducted by Ustunyurt et al.,[14] 174 individuals who had been treated and 168 patients who had not were compared. In 11 individuals, oxytocin was restarted because labour had been stopped. Oxytocin JUST ACCEPTED was stopped when aberrant FHR was discovered in 8 patients in the continuing group. The study comparing 166 continuous, 11 intermittent, and 157 discontinued persons demonstrated that the length of the active period of labour was equivalent in both groups, although being slightly longer in the discontinued group.[15]

100 patients getting continuous oxytocin and 100 patients receiving terminated oxytocin were compared in Bor et al.[16] 's study. However, due to the occurrence of labour arrest in the course of labour, 36 patients in the stopped group had their oxytocin therapy restarted. When 100 ongoing, 36 intermittent, and 64 patients were examined, The active phase of labour lasted longer in the group whose labour was halted, although this difference was not statistically significant. Oxytocin was reintroduced to 58 patients in the experiment's discontinued group by Diven et al. due to the prevalence of labour arrest in 127 continuing and

125 discontinued patients. In the study comparing 127 ongoing, 58 intermittent, and 67 patients within the discontinued group, there was a marginally longer active phase in the women who were assigned to the discontinued group. In their study, Ozturk et al.[6] evaluated how long the active phase of labour lasted for 66 patients who received halted oxytocin against 64 patients who received continuous oxytocin., and they discovered that this difference was statistically significant. This could be as a result of statistical analysis that excluded patients who experienced labour arrest and abnormal FHR. Regarding the overall time of the oxytocin infusion, a highly statistically significant difference between Group A and Group B was identified in the current investigation. Similar to this, Bostanc et al.[7] stated that the continuing group's oxytocin infusion duration was found to be much longer. Regarding the mode of delivery, In our investigation, Groups A and B did not differ statistically significantly from one another. This was contrary to the findings of Morad et al.,[12] who claimed that there were substantial variations in the delivery methods between the two groups. It was noticed that the number of CS was more frequent in continuous group A than discontinuous group B (54% vs. 26%) that represented the effect of oxytocin continuation on the mode of delivery.

Ozturk et al.[6] reported significant differences in the continued group of oxytocin infusion on the mode of delivery.

According to Kenyon et al.,[17] oxytocin was not linked to higher incidence of caesarean deliveries in women who presented with sluggish labour progress. Their meta-conclusions, analysis's, which were based on four randomised investigations, state that, they also proposed that larger oxytocin doses may be linked to a reduction in caesarean delivery rates.

Regarding uterine hyper stimulation, a very statistically significant difference between Group A and Group B was identified in this study. This contradicts the findings of Bostanc et al.,[7] who found that intermittent use of oxytocin infusion was linked to a considerably decreased rate of uterine hyperstimulation without extending labour. Although it has been noted that the continuous oxytocin group experienced more uterine hyper stimulation, neither caesarean sections nor poor neonatal outcomes were increased as a result of this hyper stimulation. Also, Ustunyurt et al.[14] reported that, Increased hyper stimulation was seen in the group that continued.

This agreed with the findings in Drummond,[18] They found that when oxytocin was administered till delivery, uterine hyper stimulation increased. The dosage and regimen of oxytocin were connected to the uterine hyperstimulation. Morad et al.[12] showed that the rate of uterine hyper stimulation and intrapartrum fetal distress was non-significantly more frequent among continuous group A than among discontinuous group B.

When oxytocin was withdrawn at the commencement of the active phase, as stated by Saccone et al. in their study.[19] Both uterine hyper stimulation and caesarean sections were found to be considerably and non-significantly less common. Stopping oxytocin during the active stage of labour had disconcerting FHR patterns, a significantly decreased incidence of caesarean sections, and uterine hyperstimulation. Stopping the oxytocin infusion was observed to lower the rates of hyperstimulation, according to Vlachos et al.[9]

Regarding an abnormal foetal heart rate, there was no statistically significant difference between Group A and Group B in the current study. In line with Bostanc et al., intermittent oxytocin infusion did not improve foetal heart rate patterns or neonatal outcomes when uterine hyper stimulation rates were reduced. The continuing group without aberrant FHR showed higher hyperstimulation.[14] While some of them discovered increased but not statistically significant aberrant FHR, Bor et al.[16] identified considerably higher abnormal FHR.[6]

4.1. Conclusion

Total duration of oxytocin infusion and uterine hyper stimulation were higher in the continuous oxytocin infusion group. Although the length of the active phase of labour appears to be the same in both groups.

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Conflict of interest

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