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Oxytocin Discontinuation or Continuing in the Active Phase of Induced Labor: Maternal and Fetal Outcomes

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Abstract

Oxytocin, the most commonly used drug to induce labor, may cause adverse effects due to uterine hyperstimulation. The aim of this study was to compare the maternal and fetal outcomes of discontinued or continued oxytocin during the active phase of labor induction. This study was conducted on 70 pregnant women referred to Baath Mission Hospital in Sanandaj, Iran. Patients were randomly assigned to have their oxytocin stimulation continued or discontinued in the active phase of labor. The average duration of the third stage of labor was longer in the oxytocin discontinued group than in the oxytocin continued group (p=0.02). Also, the duration of the first and second stages of labor was longer in the oxytocin discontinued group than in the oxytocin continued group (p=0.01 and p=0.04 respectively). Also, labor induction time was longer in the oxytocin continued group than in the oxytocin discontinued group (p=0.04). In this study, discontinued oxytocin lengthened the first, second, and third stages of labor and shortened the labor induction time. Neither discontinued nor continued oxytocin affected maternal or fetal outcomes.

Keywords: pregnancy, Labor induction, oxytocin.

Introduction

Around 25% of women who are at full term of their pregnancy have their labor artificially induced [1]. This often involves the administration of oxytocin to stimulate certain physiological responses [2]. Oxytocin is an anapeptide that is released from the posterior pituitary gland and is released in large quantities after the dilation of the cervix and vagina during childbirth. It has a half-life of 5 to 12 minutes, takes 40 minutes to reach steady-state plasma concentrations, and has a secondary uterine response of 30 minutes or more [3-7]. The use of oxytocin during labor requires careful monitoring to balance progression of labor with the risk of uterine hyperstimulation, defined as more than five contractions in 10 minutes [8-10].

Oxytocin stimulates uterine contractions by activating G-protein coupled receptors, which then trigger an increase in intracellular calcium in uterine myofibrils. When the oxytocin receptor is activated, it sends signals that boost intracellular calcium levels, resulting in uterine contractions. This is where positive feedback comes into play, as the increased contractions lead to the release of more oxytocin, which in turn intensifies and increases the frequency of contractions. This process enables a mother to carry out a vaginal delivery completely. During delivery, the baby's head pushes against the cervix, which sends nerve impulses to the mother's brain. The brain then signals the posterior pituitary gland to secrete oxytocin, which is transported via the bloodstream to the uterus, further increasing the uterine contractions. This cycle continues until parturition [11, 12].

Oxytocin during induction of labor has been studied a little and the results of the studies are contradictory [13-15]. Despite the widespread use of oxytocin, the protocol for optimal use of oxytocin is not clear. While oxytocin injections are widely used, there is still no consensus on whether they should be continued until delivery or discontinued before the active stage of labor [16, 17]. The use of oxytocin during labor may lead to maternal side effects such as nausea, vomiting, headache, hot flashes, hypotension, arrhythmia and tachycardia. Although very rare, side effects such as hyponatremia, water retention, myocardial ischemia, seizures, and coma have been reported associated with high doses of oxytocin [16-18]. The US Food and Drug Administration describe oxytocin as a drug that increases the risk of harm to the patient [17]. A standardized and specific protocol is needed to avoid maternal and fetal adverse effects due to inappropriate, excessive or unnecessary administration of oxytocin. Therefore, the purpose of this study is to compare the effect of stopping or continuing oxytocin in the active phase on maternal and fetal outcomes in labor induction.

Methods

Type of Study

The current research was a double-blind randomized clinical trial. In this type of study, participants are not given information that could influence them one way or another, whether consciously or unconsciously. The study focused on pregnant women with live fetuses who were seeking induction of labor, and who had been referred to the maternity ward of Baath Hospital in Sanandaj, Iran during the 36th to 41st week of their pregnancy.

Inclusion criteria

Pregnant women with a live fetus and indication for induction of labor at 36 to 42 weeks.

Exclusion criteria

The most significant reasons for dropping out of the study were related to complications during pregnancy and delivery. These included a history of uterine surgery, a fetus with congenital malformations, intrauterine fetal demise (IUFD), irregular fetal heart patterns, pre-eclampsia, placental abruption, rupture of membranes (ROM), placenta previa or suspected placental abruption, intrauterine growth retardation, inappropriate progress in labor, and fetal malposition.

Sample size

In this study, a sample size of 70 people in each group was estimated, with a 95% confidence level and 80% test power, considering a 60-minute difference between the two groups.

Patient assessments

In this study, patients were divided into two groups. Group 1 (Discontinued): Oxytocin was

discontinued and placebo used. Group 2 (Continued): Oxytocin was continued at the same dose until delivery.

The study involved collecting information after receiving approval and ethical clearance from the Kurdistan University of Medical Sciences. All participating women were given oxytocin infusion, which began at a rate of 3 mIU/min and was increased by 3 mIU/min every 30 minutes until they experienced regular uterine contractions of 3-5 contractions per 10 minutes. Once the cervix dilated to 4 to 6 cm, an amniotomy was performed.

All patients were regularly examined hourly to check the progress of labor and monitored every 15 minutes for fetal heart rate and uterine contractions. Maternal vital signs, uterine contractions, and fetal heart rate patterns were closely monitored throughout labor. The intensity, frequency, and duration of uterine contractions were evaluated by palpating the uterine fundus through the abdomen. The outcomes of the process include maternal outcomes such as cervical rupture, episiotomy, postpartum fever, postpartum hemorrhage, instrumental delivery, cesarean section, perineal trauma, and chorioamnionitis. Fetal outcomes may include shoulder dystocia, heart abnormality, and any possible complications which were recorded in their records.

Statistical analysis

Statistical analysis was done using SPSS version 22. The Kolmogorov-Smirnov test was used to check the normality of the data. For quantitative data, a t-test was used to compare two groups (or the Mann-Whitney test in the case of non-normality of the data). Qualitative or categorical variables were compared in two groups using the Chi-square test or Fisher's exact test. A value of less than 5% was considered a significant level.

Results

The study yielded the following results: The average age of mothers was (29.31+/-3.89) in the oxytocin discontinued group and (26.90+/-0.66) in the oxytocin continued group, with no significant difference between the two groups. Similarly, there was no significant difference in the average BMI between the oxytocin discontinued group (25.42+/-0.46) and the oxytocin continued group (25.77+/-0.43).

The average labor induction time was shorter in the oxytocin discontinued group (9.80+/-0.66) compared to the oxytocin continued group (11.10+/-0.68). The duration of the first stage of labor was longer in the oxytocin discontinued group (3.36+/-0.06) than in the oxytocin continued group (1.81+/-0.06). Also, the duration of the second stage of labor was longer in the oxytocin discontinued group (39.64+/-1.94) than in the oxytocin continued group (36.53+/-1.82). The average duration of the third stage of labor was longer in the oxytocin discontinued group (6.72+/-0.93) than in the oxytocin continued group (5.28+/-0.09) (**Table 1**).

The study showed the following results regarding maternal outcomes: There were 2 cases of large laceration in the oxytocin discontinued group and 3 in the oxytocin continued group, but the difference between the two groups was not statistically significant. There were 69 cases of episiotomy in the oxytocin discontinued group and 65 cases in the oxytocin continued group, and there was no significant difference between the two groups. No fever was observed in either group. There were 3 cases of bleeding in the oxytocin discontinued group and 7 in the oxytocin continued group, but the difference between the two groups was not statistically significant. Both groups had 2 cases of instrumental delivery. In the oxytocin discontinued group, there were no cases of cesarean section, while in the oxytocin continued group, there were 4 cases, but the difference was not statistically significant. No cases of chorioamnionitis were observed in either group. Uterine

tachysystole was not observed in the oxytocin discontinued group, but 1 case was observed in the oxytocin continued group, although the difference was not statistically significant. Dystocia was not observed in the oxytocin discontinued group, while 2 cases were observed in the oxytocin continued group, but the difference was not statistically significant (**Table 2**).

Table 1. Patient information

Baseline characteristics	Study population		
	Discontinued (n=70)	Continued (n=70)	p-value
Mean (SEM) maternal age, years	29.21±3.89	26.90±0.66	0.26
BMI	25.42±0.46	25.77±0.43	0.52
Labor induction time	9.80±0.66	11.10±0.68	0.04
First stage of childbirth: labor	3.36±0.06	1.81±0.06	0.01
Second stage of childbirth: baby delivery	39.64±1.94	36.53±1.82	0.04
Third stage of childbirth: placenta delivery	6.72±0.93	5.28±0.09	0.02

Table 2. Maternal and fetal outcomes

	Study population		
	Discontinued (n=70)	Continued (n=70)	Sig
Large laceration	2 (2.9)	3 (4.3)	Fisher's Exact Test 0.55
Episiotomy	69 (98.6)	65 (92.9)	Fisher's Exact Test 0.10
Fever	0 (0)	0 (0)	Fisher's Exact Test 1.00
Postpartum hemorrhage	3 (4.3)	7 (10.0)	Fisher's Exact Test 0.16
Instrumental delivery	2 (2.9)	2 (2.9)	Fisher's Exact Test 0.69
Cesarean	0 (0)	4 (5.7)	Fisher's Exact Test 0.06
Chorioamnionitis	0 (0)	0 (0)	Fisher's Exact Test 1.00
Uterine tachysystole	0 (0)	1 (1.4)	Fisher's Exact Test 0.05
Dystocia	0 (0)	2 (2.9)	Fisher's Exact Test 0.24

Discussion

In general, the results of this study showed that, the duration of the first, second and third stage of labor was longer in the oxytocin discontinued group than in the oxytocin continued group. However, there was no significant difference in maternal and neonatal outcomes between the groups of oxytocin discontinuation and oxytocin continuation.

In this study, it was found that there was no significant difference in the rate of cesarean section

between the group of women who continued receiving oxytocin during the active phase of labor and those who had it discontinued. Similar to our results, the study by Boie et al. (2021) showed that discontinued oxytocin during active labor does not affect increasing or decreasing the number of cesarean sections [16]. Furthermore, some parameters of our study, like the study by Boie et al. (2021) [16], showed no significant difference in maternal and neonatal outcomes between the groups that continued or discontinued oxytocin during active labor.

Eissa et al. (2017) conducted a study to determine whether stopping the infusion of oxytocin after the active phase of induced labor has a positive outcome without any adverse effects on the mother and baby. The clinical trial showed that there was a significant difference between the group that continued to receive oxytocin and the group that did not, in terms of the first stage of labor, overstimulation of the uterus, maximum and total dose of oxytocin, neonatal outcome, and incidence of postpartum bleeding [19]. These results contradict the findings of our study, which found that administering or discontinuing oxytocin had no significant effect on the mother or newborn outcomes. But similarly, in our study, the first stage of labor was longer in the oxytocin discontinued group.

In a study conducted by Capra et al. (2015) on 106 women, oxytocin infusion was started at a rate of 3 mIU/min, and cervical dilatation increased up to 4-6 cm. The study revealed that the interval of labor induction in group one was significantly less [14], which is consistent with the main results of our study.

A study conducted by Sina et al. in 2017 found that there was no significant difference between the two groups regarding the duration of the active phase, Apgar score, cesarean section rate, NICU admission, and postpartum fever. Moreover, there was no notable difference between the incidence of abnormal fetal heart rate and postpartum bleeding in both groups [18]. Similarly, our study results showed no significant variation in neonatal outcomes concerning the effect of stopping or continuing oxytocin. However, the study revealed that the duration of labor was longer in the discontinued oxytocin group compared to the continued group, and the difference was statistically significant [18].

In a review study and meta-analysis of databases, Saccone et al. (2017) found that women who randomly stopped oxytocin infusion after reaching the active phase of labor had a significantly lower risk of cesarean delivery (9.3% compared to 14.7%; relative risk 0.64) and uterine tachysystole (9.3% compared to 14.7%; relative risk 0.53) compared to those who were randomly selected to continue oxytocin infusion until delivery. Although stopping oxytocin infusion was associated with an increase in the duration of the active phase of labor [20], our study found that stopping or continuing oxytocin had no significant effect on the number of cesarean sections.

Conclusion

The results of the study indicated that when oxytocin was discontinued, the first, second, and third stages of labor were longer than usual, whereas the time required for labor induction was shorter. However, it was found that neither discontinued nor continued oxytocin had any significant impact on maternal or fetal outcomes.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Author contribution

All authors contributed equally to this article.

Ethical approval

This study was conducted based on the ethical protocol of the institution where the research was conducted. Informed consent was obtained from the patient and all patient information is protected.

Declaration of competing interest

There are no conflicts of interest.

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