FOLEY CATHETER CERVICAL RIPENING WITH EXTRA-AMNIOTIC INFUSION OF SALINE OR CORTICOSTEROIDS: A DOUBLE-BLIND, RANDOMIZED CONTROLLED STUDY

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Abstract- Induction of labor is one of the most common procedures during pregnancy. Various methods for cervical ripening and labor induction have been described in the obstetrics literature; but the role of corticosteroids in the process of labor is not entirely understood. This study challenged the possible role of corticosteroids in induction of labor by extra-amniotic injection through an inflated intracervical Foley balloon catheter. This randomized trial was conducted on 44 women with a single pregnancy, intact membranes, and an unfavorable cervix. They were randomly assigned to receive either 20 mg of dexamethasone in saline solution (study group, n=22) or saline solution only (control group, n=22) administered extra-amniotically through an intracervical inflated Foley balloon catheter. Eighteen (81.8%) patients in the study group and 20 (90.9%) in the control group entered the active phase of labor and were delivered vaginally. The mean time intervals between induction of labor to the active phase and between induction of labor to delivery were significantly shorter in the study group compared with those of the control group (3.3±2.1 hours vs. 9±4.7 hours, $P<0.01$, 5.7±3.4 hours vs. 6.9±4.7 hours, $P<0.01$, respectively). There was no maternal or fetal complication in study or control group. The intracervical Foley balloon catheter with extra-amniotic corticosteroids was more efficient in reducing the induction-to-delivery interval for termination of midtrimester pregnancies than the same Foley catheter with saline solution only. Cervical ripening with extra-amniotic corticosteroids possesses the advantages of simplicity, low cost, and lack of systemic or serious side effects.

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INTRODUCTION

Ripening of the cervix is normally a physiologic process that precedes uterine contractions and includes a highly complex biochemical process. The purpose of cervical ripening and induction of labor is to achieve vaginal delivery and to avoid operative delivery by cesarean section (1,2).

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The rate of women undergoing labor induction is increasing, primarily because of patient-physician preferences. The widespread availability of preinduction cervical ripening agents has contributed to this rising trend. Approximately half of all women undergoing an induction of labor will have an unfavorable cervix that will require some ripening agent. Pharmacologic and mechanical dilator techniques have been proven to ripen the unfavorable cervix (3).

Numerous techniques have been attempted to ripen the unfavorable cervix and enhance the changes necessary for labor in the lower uterine segment (4,5), including intravenous infusion of oxytocin (6),

which is associated with a prolonged induction period, high failure rate and considerable patient discomfort (7,8,2), intravaginal or intracervical administration of prostaglandin (9-15), which could cause uterine tetany (16,17), and intracervical Foley balloon catheter insertion (12-14), which ripens the cervix mechanically, usually without causing contractions (18-20).

The role of corticosteroids in the process of labor is not entirely understood. Nevertheless, several reports have suggested that intramuscular or intraamniotic injection of corticosteroids results in higher rates of induction of labor and vaginal deliveries in lambs and humans (21-23). Some assumptions regarding their possible role in parturition have been proposed as being effective in a paracrine or autocrine fashion because receptors for glucocorticoids have been identified in the amniotic membranes (24). So, local corticosteroids may be involved in the course of labor induction.

The aim of this study was to examine the hypothesis that corticosteroids, when administered extra-amniotically, can enhance the labor process and reduce the induction-to-delivery interval.

MATERIALS AND METHODS

In this randomized controlled trial we compared extra-amniotic injection of corticosteroids with injected saline solution for cervical ripening and induction of labor.

This double-blind, randomized controlled study was conducted on 44 women with singleton gestations and a gestational age of 36 to 42 weeks, who were referred to the Mahdieh Hospital in Tehran, Iran, for induction of labor with a Bishop score of less than or equal to 5 from February 2000 through March 2001.

The indications for labor induction during the study period included postdate pregnancy, suspected fetal distress, hypertensive disorders, intrauterine growth restriction, premature rupture of membranes, oligohydramnios, chorioamnionitis, abruptio placentae, and maternal diabetes.

Exclusion criteria were known uterine anomaly, invasive cervical carcinoma, cephalopelvic disproportion (because of malpresentation or abnormal pelvic bone structures), known placenta previa or low-lying placenta, vasa previa, reported or documented episode of midtrimester or third-trimester bleeding, active genital herpes infection, maternal fever, intrauterine fetal death, previous classical uterine incision, and three or more uterine contractions in 10 minutes. Eligible patients were informed of the purpose of the study and were requested to sign an informed consent that was approved by the local Institutional Review Board for Human Investigations. After giving their consent, patients were assigned to one of two arms according to a computer-generated random list. The type of therapy given in each group was blinded to both patients and physician.

Patients who required cervical ripening and induction were randomized to one of 2 groups:

1) In study group, a 26F catheter with a 30 ml balloon was inserted under direct vision through the cervix of patients, using sterile technique. The balloon was inflated with 30 ml of sterile water, and 20 mg of dexamethasone mixed with sterile saline solution up to a volume of 20 ml was injected through the catheter into the extra-amniotic space, followed by infusion of 1 ml/min of sterile saline solution into the extra-amniotic space by means of an infusion pump. The balloon was then taped to the patient's inner thigh.

2) In control group, women received the same treatment except that 20 mg of corticosteroids was replaced by 20 ml of pure saline solution.

The patients were monitored for fetal heart rate every 20 minutes during the first hour and then every hour for the next 5 hours. Gentle traction of the catheter was performed every hour to watch for expulsion of the balloon. If the balloon was not expelled within 6 hours, it was deflated and extracted. Thereafter intravenous oxytocin was administered in an initial dose of 2.5 mIU/min, with subsequent increase of 2.5 mIU/min every 20 minutes until three contractions in 10 minutes were achieved (as long as the fetal heart rate was satisfactory). After a further 2 hours the patients were reexamined for Bishop score. Only when the patient entered the active phase of labor, which was defined as three or more contractions in 10 minutes and

cervical dilatation ≥4 cm, the protocol was continued. If the patient did not demonstrate these minimal conditions, oxytocin was stopped and failure of induction was announced. Amniotomy was permitted only in the active phase.

The patients were followed up for the common complications of balloon application: nausea and vomiting, uterine hypertonus, and febrile morbidity. Since cord blood gas test is not routinely performed in our medical center, neonatal outcome assessment included Apgar score.

Mean values of maternal age, gestational age, and time intervals were compared between the study and control groups with use of the two-sample *t* test. *P* values less than 0.05 were considered statistically significant.

RESULTS

Forty-four subjects (study group 22, control group 22) were enrolled in the study. Table 1 shows the clinical characteristics in the two groups. There were no statistical differences in maternal age, gestational age or parity between the two groups. Indications for induction of labor are depicted in table 2. There was no significant difference between two groups in any of indications.

Eighteen (81.8%) patients in the study group and 20 (90.9%) in the control group entered the active phase of labor. The mean interval from induction of labor to the active phase was significantly shorter in the study group (3.3±2.1 hours) compared with the control group (4.9±4.7 hours, $P<0.01$) (Fig. 1).

All of the women who entered the active phase of labor were delivered vaginally (18 patients in the study group and 20 in the control group).

Table 1. Clinical data in two groups*†

Parameters	Study group (n=22)	Control group (n=22)
Maternal age (yr)	23.2±5.2	26.2±4.9
Gestational age (week)	41.1±1.9	41.2±1.7
Primigravid	54.5‡	36.4‡

*Data are presented as mean±SD unless otherwise specified.
† No significant difference was found between groups in any of parameters.
‡ Percent.

Table 2. Indications for labor induction*†

Indications	Study group (n=22)	Control group (n=22)
Postdates	54.6	68.1
Suspected fetal distress	4.5	18.2
Hypertensive disorder	40.9	18.2
Maternal diabetes	0	4.5
Intrauterine growth restriction	0	0

*Data are presented as percent.
†No significant difference was found between groups in any of parameters.

Table 3 demonstrates the route of delivery in the two groups. There was no significant difference in the rate of cesarean delivery between the two groups. The time interval between induction of labor and delivery was significantly shorter in the study group (5.7±3.4 hours) versus the control group (6.9±4.7 hours, $P<0.01$) (Fig. 1).

No maternal or fetal complication was seen in study or control group and there was no significant difference between two groups with respect to maternal or fetal complications. Nevertheless, the sample size was not sufficient to rule out a significant difference in the rate of complications with appropriate power.

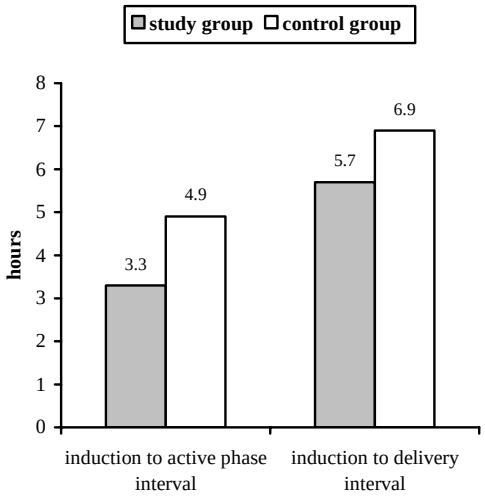

Fig. 1. Time (mean) from induction to active phase and delivery after corticosteroid (black columns) or saline (white columns) infusions.

Table 3. Route of delivery in two groups*†

Mode of delivery	Study group (n=22)	Control group (n=22)
Spontaneous vaginal	18 (81.8)	20 (90.9)
Instrumental	0(0)	0(0)
Cesarean section		
Fetal distress	2 (9.1)	0(0)
Thick Meconium	1 (4.5)	2 (9.1)
No progress	1 (4.5)	0 (0)

*Data are presented as number (percent).
† No significant difference was found between groups.

DISCUSSION

One of the common practices of modern obstetrical care is to induce labor and delivery when fetal and/or maternal complications arise (3,25). Various methods and agents of cervical ripening and labor induction have been described in the obstetrics literature (2).

Regardless of the ripening agent used, each has been shown to significantly improve the preinduction cervical score, shorten the induction to vaginal delivery time, and reduce the need for oxytocin (3).

In a review of 11 reported studies, it has been suggested that ripening efficacy by catheter balloon is similar to, or better than, other methods (25); however our study demonstrated a possible role of corticosteroids, acting locally in the fetal membranes, in shortening the time interval from induction of labor to delivery in pregnancies requiring induction, which was in agreement with previous study by Barkai *et al.* (26).

The amniotic membranes in the human placenta express receptors for glucocorticoids at term (24). Also, the level of cortisol rise in the amniotic fluid throughout the pregnancy, especially before the appearance of regular contractions at term (27,28). The current study was designed to evaluate the theory that glucocorticoids could facilitate the induction and delivery processes. It was decided to choose an inert method for induction of labor to minimize the possible effect of other medications on the study group. Furthermore, we decided to use the inflated Foley balloon catheter method because of its effectiveness with minimal known complications compared with other methods. The catheter is also used as an injection route for the corticosteroids.

The results of this study demonstrated that glucocorticoids, when given extra-amniotically by a Foley catheter inflated at the cervical internal os, was a more efficacious method for ripening of the cervix than extra-amniotic saline infusion. Also, it revealed that extra-amniotic glucocorticoids infusion can shorten both the interval from induction to the entrance at the active phase and the induction-to-delivery interval, which was similar to Barkai *et al.* report (26). We found no side effects from this method for either the mother or the baby. The method has a low cost and requires little training for the untrained physician at the delivery room when a quick and safe method is required for induction of labor.

Ripening of the cervix and induction of labor are debatable issues. The variety of results with use of the conventional methods of ripening of the cervix and induction of labor has been reported. Hence future research is clearly needed to explore whether corticosteroids may serve this goal and to develop novel management strategies for women deemed at highest risk of induction failure. These investigations are required at a clinical level to establish the best dosage of glucocorticosteroids to be injected extra-amniotically and at the level of tissue culture to understand better the relationship between the activities of glucocorticoids at their receptor level of amniocytes.

In conclusion, induction of labor with use of an intracervical Foley balloon catheter and extra-amniotic corticosteroids reduces the time interval from induction of labor to delivery. Lastly, continued research in this important area of clinical obstetrics is needed to evaluate the most appropriate dosing regimens for all of the available agents at hand.

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