



# Nitrous Oxide Versus Lidocaine for Pain Relief During Episiotomy Repair: A Randomized Trial

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## Abstract

**Objectives:** Since pain management is an important concern in childbirth. This study was designed to evaluate the effects of nitrous oxide in comparison with lidocaine in terms of pain relief, during episiotomy repair in primiparous women.

**Materials and Methods:** In this prospective randomized controlled trial, 120 pregnant women were recruited. The intervention group received nitrous oxide 2 minutes before starting episiotomy repair, until the end of the procedure. The control group received 5 mL of lidocaine (2%) before starting the episiotomy. The results of 2 groups were compared with regard to the pain intensity using a visual analog scale (VAS). Mann-Whitney, student's t test, and chi square test were used to analyze the data.

**Results:** Sixty women were studied in each group. Nine participants (15%) in nitrous oxide group, as opposed to 23 (38.4%) in lidocaine group, had moderate, severe or extremely severe pain ( $P = 0.005$ ). In terms of satisfaction level, there was no significant difference between 2 groups ( $P = 0.713$ ).

**Conclusion:** The results of this study showed that pain intensity in the nitrous oxide group was significantly lower than that in the lidocaine infiltration group. Application of nitrous oxide at least 2 minutes before repair may be an effective method for pain management in episiotomy repair.

**Keywords:** Nitrous oxide, Episiotomy, Lidocaine, Pain

## Introduction

For nearly 80 years, episiotomy has been routinely performed but there is no strong evidence of its effectiveness, hence it has remained controversial (1). The prevalence of episiotomy varies from 10% in developed countries (e.g., Sweden) to 100% in developing countries (e.g., Taiwan) (2,3). Episiotomy repair requires anesthesia, and lidocaine is usually used for this purpose (4). Infiltration of lidocaine can cause accidental intravascular injection and burning sensation, and edema due to the insertion of needle (5). Today, non-injectable methods have a new place in medicine to reduce pain. Nitrous oxide (combination of  $N_2$  and  $O_2$  with the same ratio of 50%) has strong analgesic effects (equivalent to 15 mg of subcutaneous morphine) and is frequently used in childbirth and emergencies by medical professionals (6).

Studies have shown that nitrous oxide or Entonox can be utilized as an analgesic agent in obstetric, cancers, intra-articular injections, sigmoidoscopy, colonoscopy, and biopsy (7), and it appears to provide effective analgesia for many parturient women (7,8). It was not, however, effective in reducing pain in shoulder joint dislocation repair in a study (9). The peak effect of nitrous oxide occurred within 30 seconds after inhalation and persisted for about 1 minute and gradually decreased in 5 minutes

after inhalation (10). Nitrous oxide induces the release of endorphins and at higher concentrations, they provide analgesia, as well as skeletal and muscular relaxation (6). Unfortunately, despite warning against the routine use of episiotomy, this procedure is performed for the majority of primiparous women in developing countries (3,11). There are a considerable number of investigations about the repair of perineal tear and pain relief after episiotomy (12,13) but there are few reports on the effectiveness of analgesia during perineal suturing (14). Since pain is an important concern in childbirth and using episiotomy is inevitable in some necessary cases, this randomized clinical trial was conducted to evaluate the effectiveness of nitrous oxide in comparison to lidocaine on pain intensity during episiotomy repair in primiparous women.

## Materials and Methods

### Study Design and Participants

This prospective randomized controlled clinical trial was conducted on the primiparous women who attended a referring academic hospital in Southwest of Iran (Shushtar). Inclusion criteria were: primipara women between 39 and 42 weeks of gestation according to sonographic findings or last menstrual period, mother's age within 18-35 years, singleton gestation, uncomplicated pregnancy, cephalic

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presentation and first-trimester body mass index (BMI) in the range of 18.5-30 kg/m<sup>2</sup>. Women were excluded if they had operative delivery, perineal laceration or large episiotomy, intact perineum and previous sensitivity to local anesthesia or nitrous oxide. It is worth to mention that using opioids, inhalation or pudendal block for labor pain relief is not common in our institutions.

### Setting and Sampling

The primary outcome measure of the present study was pain intensity during episiotomy repair and secondary outcomes were satisfaction with the anesthesia and side effects of nitrous oxide (N<sub>2</sub>O). The power of the study was calculated based on a previous study in which mean pain intensity during perineal repair was 4.24 ± 2.78 (14). Based on a study potency of 80%, alfa equal to 0.05, parameters of previous studies and attrition of 30%, the sample size was determined 120 women (60 women in each group) (Figure 1). Women were allocated by block randomization in a 1:1 ratio to each group with the use of block randomized computer-generated list. The allocated arm was written on the cards which were sealed in sequentially numbered opaque envelopes. The envelopes were opened after the enrolled women had completed the basic evaluations. Groups were compared with regard to the pain intensity using a visual analog scale (VAS). According to this scale, zero indicated no pain, 1-3 mild, 4-6 moderate, 7-9 severe and 10 expressed extremely severe pain (15).

Participants received the explanation and were fully informed about the procedures. Confounding variables were matched for 2 groups which included incision length, type of incision, type of incision repair, and number of vaginal examinations. The procedure of episiotomy and

repair was performed by one of the midwives of the institute (A.H). She was there 6 hours per day, 4 days per week, in different working times from July to September 2015. All episiotomies were performed as mediolateral episiotomy after fetal head crowning at the top of contraction. Data gathering was done by another staff, unaware of the type of analgesia. In the delivery room after placental delivery, the control group received routine care and 5 mL of lidocaine (2%) along the edges of the episiotomy with frequent aspirations before starting the episiotomy repair. Women in the intervention group received routine care and inhaled nitrous oxide deeply and slowly 2 minutes before the start of episiotomy repair until the end of the procedure as they were trained. Entonox mask was worn on the mother's face for repeated inhalation, according to the respiration model "deep inhale- pausing- slow exhale-rest". The women were free to use nitrous oxide whenever they liked. In all cases, episiotomies were repaired with routine technique. In Iran, mediolateral episiotomy is a common procedure especially in primipara women and the absorbable catgut is used for episiotomy repair. The duration of nitrous oxide use, respiratory rate, pulse rate, blood pressure and O<sub>2</sub> saturation were recorded by a staff before, during, and after episiotomy repair. Pain intensity was measured using VAS after repair in the postpartum care unit. In VAS measurement scale, number 5 was deemed as acceptable pain intensity. The questionnaire and checklist were designed based on scientific resources and 10 faculty members confirmed the content validity of the tools.

Mothers' satisfaction in 2 groups was evaluated using the scale of completely satisfied, satisfied, unsatisfied, and completely unsatisfied and adverse effects of N<sub>2</sub>O were

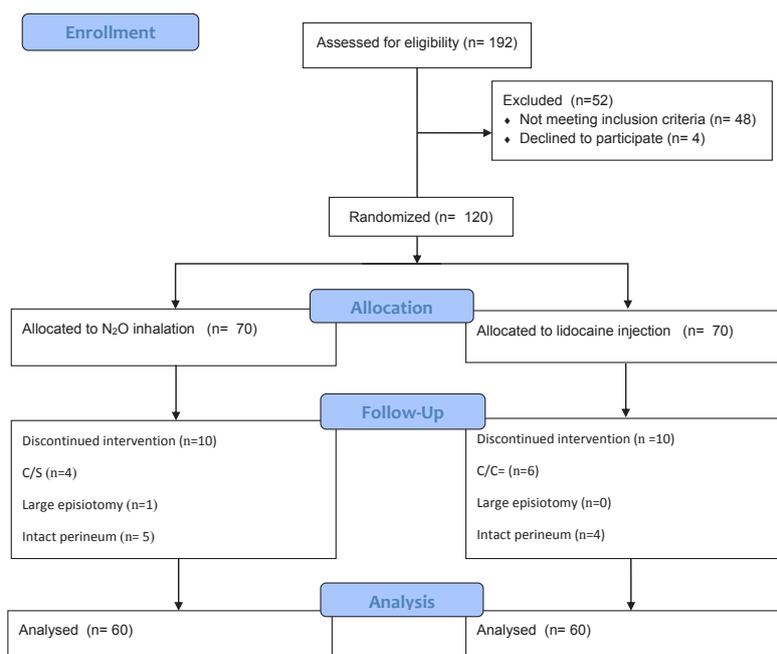


Figure 1. Recruitment and Retention of Participants in the Study.

assessed in the intervention group.

### Statistical Analysis

Data analysis was performed using SPSS version 16.0. Normality of the quantitative variables for the groups was not confirmed using Kolmogorov-Smirnov test. The Mann-Whitney U test was used to compare nonparametric variables and the *t*-test was performed for continuous parametric variables (neonatal birth weight and head circumference). The chi-square test was performed for categorical data and differences were considered significant if *P* value was less than 0.05.

### Results

The groups showed no statistically significant difference in maternal age, education, BMI, neonatal birth weight, head circumference, duration of second and third stages of labor, and gestational age (LMP and sonography). The duration of episiotomy repair was significantly lower in N<sub>2</sub>O group (Table 1). Clinical properties (pulse rate, respiratory rate, blood pressure, O<sub>2</sub> saturation) and other conditions such as rupture of amniotic membrane, need for labor induction, participation in childbirth preparation classes, exercises and perineal massage during pregnancy were not significantly different between 2 groups (*P* > 0.05).

None of the women in the intervention group needed lidocaine in addition to N<sub>2</sub>O to relieve the pain, and all tended to use N<sub>2</sub>O until the end of the perineal repair.

The rate of adverse effects for the N<sub>2</sub>O group showed that 20 patients (33.3%) had no special side effects, 26 patients (43.3%) had dizziness, 7 patients (11.7%) had dryness of the mouth (xerostomia), and 7 cases (11.7%) showed drowsiness. Adverse effects were temporary and

were eliminated after the termination of inhalation. Pain intensity in the N<sub>2</sub>O group using VAS was significantly lower than that in the lidocaine group (*P* < 0.005) (Table 2). The satisfaction level had no significant difference in 2 groups (*P* = 0.713) (Table 3).

### Discussion

The use of N<sub>2</sub>O in the process of labor and postpartum is not commonly considered in developing countries (16), especially for episiotomy or perineal repair. Evidence suggests that there is a considerable pain during perineal suturing but the amount and intensity of the pain women experience during this procedure is not well understood (17). N<sub>2</sub>O is a nonflammable, tasteless, odorless gas and the intermittent use of 50% N<sub>2</sub>O in oxygen which is most widely adopted, probably optimizes patient safety (17). The statistically significant findings of this study indicated that N<sub>2</sub>O may be effective in alleviating pain intensity during episiotomy repair when compared with lidocaine (*P* = 0.005). The study of Kindberg et al (18) showed that lidocaine was more effective compared with acupuncture in reducing the pain intensity during the episiotomy repair. In a clinical trial published by Berlit et al (19), the statistical difference between N<sub>2</sub>O and lidocaine in reducing the pain during the repair of genital lacerations was not significant (*P* = 0.69), which was not consistent with the findings of the present study. The findings of our study were similar to those reported by Franchi et al who compared the use of topical Emla cream (*n* = 31) with the injection of Mepivacaine (*n* = 30) for perineal repair. They showed that pain reduction and maternal satisfaction were higher in the Emla group (20).

Although some studies have indicated that N<sub>2</sub>O can be used as analgesic for pain relief during the first, second,

**Table 1.** Demographic and Labor Characteristics

	N <sub>2</sub> O, n = 60	Lidocaine, n = 60	<i>P</i> Value
Maternal age (y)	23±4.26	23.25±4.28	0.740
Education			0.125
Illiterate	1 (1.7%)	3 (5%)	
High school diploma	31 (51.7%)	31 (51.7%)	
Diploma	20 (33.3%)	11 (18.3%)	
University degree	8 (13.3%)	15 (25%)	
Body mass index (kg/m <sup>2</sup> )	23.08±3.68	23.62±2.99	0.891
Birth weight (g)	3242.500±249.715	3270.833±329.77	0.597
Gestational age (LMP)	40.0±2.5	40.0±2.1	0.996
Gestational age (Sonography)	40.0±2.5	40.0±2.0	0.695
Neonatal head circumference (cm)	34.15±0.98	34.23±0.95	0.654
Duration of second stage of labor (min)	47.50±25.47	46.50±33.05	0.309
Duration of third stage of labor (min)	7.6±8.7	8.1±9.9	0.061
Duration of episiotomy repair (min)	15.3±7.1	17.2±8.5	0.001

Values are expressed as mean ± SD; means were compared by Mann-Whitney U test or *t*-test (for continuous data); categorical data were compared by  $\chi^2$ .

**Table 2.** Pain Severity Measurement During Episiotomy Repair Between Nitrous Oxide and Lidocaine Groups Using VAS

	N <sub>2</sub> O, n = 60	Lidocaine, n = 60
	No. (%)	No. (%)
Pain severity <sup>a</sup>		
Mild	51 (85)	37 (61.7)
Moderate	9 (15)	18 (30)
Severe	0 (0)	4 (6.7)
Extremely severe	0 (0)	1 (1.7)

<sup>a</sup> *P* = 0.005.**Table 3.** Satisfaction Rate During Episiotomy Repair in 2 Groups of Nitrous Oxide and Lidocaine

	N <sub>2</sub> O, n = 60	Lidocaine, n = 60
	No. (%)	No. (%)
Satisfaction rate <sup>a</sup>		
Unsatisfied	0 (0)	1(1.7)
Satisfied	32(53.3)	34(56.7)
Completely satisfied	28(46.7)	25(41.7)

<sup>a</sup> *P* = 0.713.

and third stages of labor and postpartum procedures such as perineal repair, manual removal of placenta or uterine curettage (21), the majority of references suggest infiltrative anesthesia as an effective method for reducing pain during episiotomy suturing. Some evidence also suggested the administration of N<sub>2</sub>O in addition to lidocaine for better pain control (22); in contrast, some investigations revealed that pain relief with N<sub>2</sub>O does not need additional medication (17). There are no considerable clinical trials about pain management during episiotomy repair. In the present study, none of the participants in 2 groups needed additional anesthesia, and satisfaction of the used method was the same between 2 groups. The chi square test results did not show any significant difference between the N<sub>2</sub>O and lidocaine groups (*P* = 0.173). In Berlit and colleagues' investigation, the addition of prilocaine (31% in the study and 2% in the control groups) was necessary and the satisfaction did not significantly differ between 2 groups (19). Gutton et al (23) reported an improvement in analgesia and maternal satisfaction when ropivacaine was used in contrast to lidocaine for perineal infiltration post-episiotomy, and in the study of Kindberg et al (18) satisfaction from acupuncture was significantly lower than that from lidocaine (*P* = 0.01).

The most prevalent side effect in this study was dizziness. In the present study, all side effects were transient and relieved after the termination of inhalation. The study of Berlit et al showed that Entonox was 45% without side effects, dizziness (35%), euphoric (31%), and nausea (4%) which are all transient and this was consistent with the result of this study (19). Similar studies reported side effects such as dry mouth, dizziness, drowsiness, and nausea (24,25).

In the N<sub>2</sub>O group, the duration of episiotomy repair was significantly lower than that in the lidocaine group. It may be due to the release of endorphin, musculoskeletal relaxation, and better cooperation of woman during perineal suturing in the intervention group.

The power of this study was the detection of perineal pain simply during episiotomy repair and for primiparous participants. This may help us to arrive at a meaningful conclusion on the effect of N<sub>2</sub>O on the pain alleviation during the episiotomy suturing.

The present study had some limitations which were out of control. For example, the midwife who performed the episiotomy was aware of the analgesic method and also the participants were different in the pain threshold (difference in expressing the pain and its effect on final evaluation) and also the women's response to pain intensity was different. Although VAS was used in the majority of studies as a valid instrument for measurement of acute pain and also episiotomy pain, the research team suggests performing further randomized studies using other pain measurement scales.

### Conclusion

This study showed probable improvement in episiotomy analgesia via N<sub>2</sub>O inhalation in terms of maternal pain reduction and satisfaction.

### Conflict of Interests

Authors declare that they have no conflict of interests.

### Ethical Issues

This study was approved by the Ethics Committee of Ahvaz Jundishapur University of Medical Sciences (N0. IR.AJUMS.REC.1394.151, 5.6.2015). The protocol of the study was registered in the Iranian Registry of Controlled Trials (Identifier: IRCT2015062222874N1). The goals of the study were explained to mothers and informed consent form was signed by each participant. They could withdraw at any time during the research..

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