



Original Contribution

Nitrous oxide for labor analgesia: Utilization and predictors of conversion to neuraxial analgesia



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ABSTRACT

Study Objective: We examined the characteristics of women who choose nitrous oxide for labor analgesia and identified factors that predict conversion from nitrous oxide to labor neuraxial analgesia.

Design: Retrospective descriptive study.

Setting: Labor and Delivery Ward.

Patients: 146 pregnant women who used nitrous oxide for analgesia during labor and delivery between September 2014 and September 2015.

Interventions: Chart review only.

Measurements: Demographic, obstetric, and intrapartum characteristics of women using nitrous oxide were examined. Multivariable logistic regression was performed to identify factors associated with conversion from nitrous oxide to neuraxial analgesia. Data are presented as n (%), median [IQR], adjusted relative risk (aRR), and 95% confidence intervals (CI) as appropriate.

Results: During the study period, 146 women used nitrous oxide for labor analgesia (accounting for 3% of the total deliveries). The majority (71.9%) of women who used nitrous oxide were nulliparous, and over half (51.9%) had expressed an initial preference for “nonmedical birth.” The conversion rate to neuraxial blockade was 63.2%, compared to a concurrent institutional rate of 85.1% in women who did not use nitrous oxide. Factors associated with conversion from nitrous oxide to neuraxial blockade were labor induction (aRR = 2.0, CI 1.2–3.3) and labor augmentation (aRR = 1.7, CI 1.0–2.9).

Conclusion: Only a small number of women opted to use nitrous oxide during labor, analgesia was minimal, and most converted to neuraxial analgesia. Women with induced and augmented labors should be counseled about the increased likelihood that they will convert to neuraxial analgesia.

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1. Introduction

Nitrous oxide is an anesthetic gas with NMDA antagonistic properties that offers rapid-onset inhaled mild analgesia. The first description of its use during labor and delivery was in 1881 [1], and women throughout the world continue to use it as a labor analgesic today. The minimally invasive delivery method of nitrous oxide offers a modality for managing labor pain that appeals to women who desire labor analgesia without a neuraxial block. This group of women could comprise a significant proportion of obstetric patients, with 26% of women expressing a preference for delivery without neuraxial analgesia in a 2010 national survey performed in France [2]. However, until recently,

nitrous oxide was not widely available in the United States [3]. In a nationwide survey performed in the United States in 2000, only a small minority of women (2%) reported using nitrous oxide [4]. Since that time, patient expectations fueled by media coverage have promoted greater nitrous oxide use in the United States. The availability of nitrous oxide for labor analgesia has increased from only five United States institutions in 2012 [3] to several hundred hospitals and birth centers in 2016 [5].

Cultural and societal expectations play a large role in labor preferences [6,7]. Despite the recent resurgence of nitrous oxide use for labor analgesia in the United States, few studies have examined populations of women that use nitrous oxide for labor analgesia that are applicable to pregnant women in the United States today. The utilization of nitrous oxide for labor analgesia, the rate of conversion from nitrous oxide to neuraxial analgesia for labor, and predictors of which patients are most likely to convert to neuraxial analgesia are unknown. This information can assist anesthesia providers in the United States who are interested in offering a new nitrous oxide service for labor analgesia to

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help determine expected demand and utilization. It will also help anesthesiologists to tailor their labor analgesia counseling and consent to individual patients who are more likely to convert to neuraxial analgesia.

The primary aim of this study was to determine the utilization and characteristics of women who choose to use nitrous oxide for labor analgesia. The secondary objective was to evaluate factors that predict the conversion to neuraxial analgesia.

2. Materials and methods

After obtaining Stanford University IRB approval, we reviewed electronic medical records of women who used nitrous oxide for labor analgesia over 13 months (September 2014 to September 2015). The study was conducted at Lucile Packard Children's Hospital, a tertiary obstetric center with approximately 4500 deliveries per year and a labor epidural rate of over 80%.

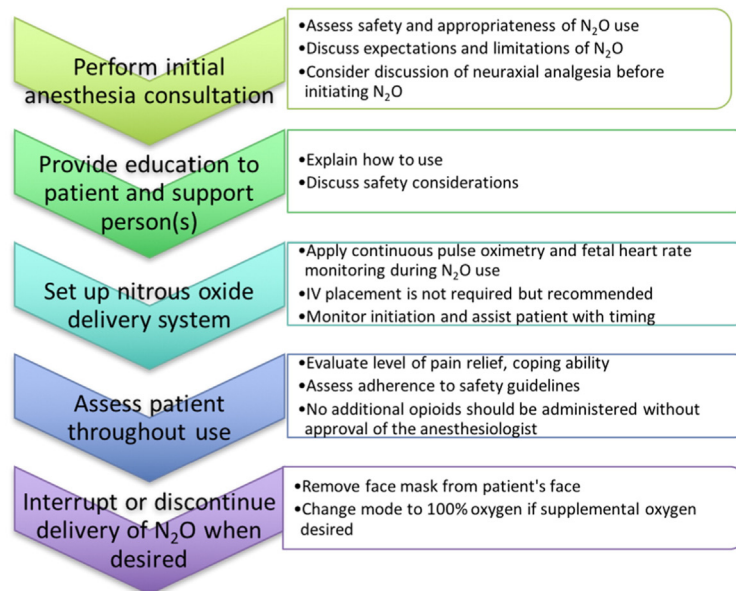
There is dedicated, "around-the-clock" anesthesia coverage for the obstetric patients, with anesthesia care provided by an anesthesiologist attending, residents, and fellows. At our institution, we offer intravenous opioids, nitrous oxide, and neuraxial analgesia as labor analgesic options. Currently, only the obstetric anesthesia team prescribes and initiates nitrous oxide, and a standardized protocol is followed (Fig. 1). Indications for nitrous oxide include labor pain as well as other painful obstetric procedures, including assisted delivery, laceration/episiotomy repair, manual removal of placenta, uterine exploration/examination, external cephalic version, and difficult vaginal exams. Contraindications to the use of nitrous oxide include inability of the patient to hold face mask; impaired level of consciousness; decreased oxygenation; category III fetal heart tracing; or recent history of trauma, pneumothorax, increased intracranial or intraocular pressure, bowel obstruction, middle ear or intraocular surgery, emphysema, or pulmonary hypertension.

Pregnant women self-administer nitrous oxide using a gas mixer in a fixed ratio of 50% nitrous oxide:50% oxygen (Sedara Healthcare, The Linde Group, Munich, Germany).

All electronic medical records between September 2014 and September 2015 which involved the use of nitrous oxide at any time during a woman's labor and delivery were reviewed. For our primary study aim of examining the characteristics of patients who used nitrous oxide, we abstracted the following data: demographic information, the patient's initial analgesic preference from the birth plan documented at admission to the labor and delivery suite, relevant obstetric data (including labor stage and cervical dilation at time of initiation of nitrous oxide, labor induction, and labor augmentation), numerical verbal pain scores (VPS, 0 = no pain and 10 = worst pain imaginable) prior to and just after nitrous oxide initiation, as well as all pain scores recorded by the nurse until either delivery or epidural placement. We also abstracted duration of nitrous oxide use, rate of conversion to neuraxial labor analgesia, and mode of delivery. Side effects (e.g. maternal dizziness) related to nitrous oxide administration noted in the anesthetic or nursing records were also recorded.

As a secondary objective, factors that were associated with conversion from nitrous oxide to neuraxial analgesia for labor were evaluated. We created a multivariable regression model to determine if any factors were predictors of conversion to neuraxial analgesia. While our primary aims were descriptive, we used methods as described in the STROBE statement for the comparative analysis.

We compared the neuraxial analgesia rates between patients who did and did not use nitrous oxide. To determine the rate of neuraxial labor analgesia in patients who did not use nitrous oxide, the number of patients who received neuraxial labor analgesia but not nitrous oxide was divided by the sum of all vaginal deliveries and intrapartum cesarean deliveries performed with epidural during the same study period.



Tips for Teaching the Patient to Use Nitrous Oxide:

Patient must be sitting or lying in bed during actual use. She may ambulate between inhalations.

Face mask must be held tightly against face when inhaling.

Patient should breathe slowly and deeply. Panting/shallow breaths interferes with adequate pain relief.

Ideally, inhalation of gas should begin 30 seconds prior to onset of a contraction to allow for peak effect at the time of contraction. ONLY the PATIENT is allowed to hold the mask to her face

Fig. 1. Institutional protocol for the use of N₂O during labor. N₂O: nitrous oxide.

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