External cephalic version: success rates with and without nitrous oxide

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Abstract

Objective To compare the conversion rate of non-cephalic to cephalic presentation in external cephalic version (ECV) with and without nitrous oxide Design Retrospective cohort study Setting Single, tertiary care institution between January 2016 an June 2017 Population Women with singleton, term gestation ECVs identified via International Classification of Diseases Clinical Modification diagnosis code with breech or malpresentation. Pregnancies with preterm, multi-fetal gestation, abnormal placentation, and rupture of membranes were excluded Methods Logistic regression was performed to test whether nitrous oxide was associated with successful conversion to cephalic presentation. Main Outcomes The primary outcome was successful rate of conversion to cephalic presentation. The secondary outcome was the rate of vaginal delivery. Results During the study period, 167 women underwent ECV: 77 with nitrous oxide and 90 without nitrous oxide. Of the 77 women who used nitrous oxide, 25 (32.5%) were successful and 17 of these women delivered vaginally (68%). Of the women who underwent ECV without nitrous oxide, 29 (32.2%) successfully converted and 21 of these delivered vaginally (72%). After controlling for confounders, the use of nitrous oxide had no clinically or statistically significant difference on ECV success rates (OR 1.08, 95% CI 0.52-2.23). Conclusion Nitrous oxide does not seem to affect conversion rate to cephalic presentation in ECV. Further studies are needed to determine the impact of nitrous oxide on women's decision to undergo ECV and on patient satisfaction and tolerability. Funding The authors received no financial support for the research, authorship, or publication of this data.

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This study was designed, directed and coordinated by T.H. and M.R. Data analysis was performed by C.B. The manuscript was written by T.H. and R.L. and commented by all authors.

Key words and phrases: external cephalic version, breech presentation, malpresentation, vaginal delivery, nitrous oxide, obstetrics, cesarean delivery, anesthesia

Abstract

Objective

To compare the conversion rate of non-cephalic to cephalic presentation in ECV with and without nitrous oxide.

Design

A retrospective cohort study

Setting

Single, tertiary care institution between January 2016 and June 2017

Population

Women with singleton, term gestation ECVs identified via International Classification of Diseases 9th Edition and 10thEdition, Clinical Modification diagnosis code with breech or malpresentation. Pregnancies with preterm gestation, multi-fetal gestation, abnormal placentation, and rupture of membranes were excluded

Methods

Logistic regression was performed to test whether nitrous oxide was associated with successful conversion to cephalic presentation.

Main Outcomes

The primary outcome was successful rate of conversion to cephalic presentation. The secondary outcome was the rate of vaginal delivery.

Results

During the study period, 167 women underwent ECV: 77 with nitrous oxide and 90 without nitrous oxide. Of the 77 women who used nitrous oxide, 25 (32.5%) were successful and 17 of these women delivered vaginally (68%). Of the women who underwent ECV without nitrous oxide, 29 (32.2%) successfully converted and 21 of these delivered vaginally (72%). After controlling for confounders, the use of nitrous oxide had no clinically or statistically significant difference on ECV success rates (OR 1.08, 95% CI 0.52-2.23).

Conclusion

Nitrous oxide does not seem to affect conversion rate to cephalic presentation in ECV. Further studies are needed to determine the impact of nitrous oxide on women's decision to undergo ECV and on patient satisfaction and tolerability.

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Introduction

Cesarean delivery is one of the most common obstetric procedure in the United States where almost one in three women are delivered surgically 1,2. Rising cesarean delivery rates are a major concern due to the higher risk of maternal morbidity and mortality as well as substantial health care cost in comparison to vaginal delivery. Breech presentation occurs in 4% of term pregnancies and is a common indication for cesarean delivery3. External cephalic version (ECV) is a technique of applying manual pressure on the maternal abdomen to convert the fetus to cephalic presentation. If successful, this reduces the incidence of cesarean delivery and confers advantages in maternal recovery and avoidance of surgical complications. For these reasons, the American College of Obstetrics and Gynecology (ACOG) and the Society of Maternal Fetal Medicine (SMFM) encourages ECV as a technique to prevent cesarean delivery and reduce the risk of complications in subsequent pregnancies3.

Variables associated with higher rates of successful conversion to cephalic presentation include: multiparity, gestational age, fetal position, placental location, and maternal habitus4-6 . There have been several randomized control trials which demonstrate that higher success rates of ECV are attributable to neuraxial anesthesia due to improved tolerability of procedure7-10. We hypothesize that nitrous oxide, an inhaled anesthetic, would improve the success rates of ECV to cephalic presentation. We compared outcomes in a cohort of women with breech presentation who underwent ECV with the use of nitrous oxide and without the use of nitrous oxide. The primary outcome was successful conversion to cephalic presentation and the secondary outcome was vaginal delivery.

Methods

A retrospective cohort analysis was performed on all ECVs identified between January 2016 and July 2017 through a perinatal database of delivery records at the University of California, San Francisco. This dataset includes International Classification of Diseases 9th Edition and 10th Edition, Clinical Modification (ICD-9-CM/ ICD-10-CM) diagnosis and procedure codes. Women with the following ICD 9 and ICD 10 codes or procedure codes were included in the study: maternal care for breech presentation, not applicable or unspecified (O32.1XX0), breech or other malpresentation successfully converted to cephalic presentation, antepartum (652.13), breech presentation, antepartum (652.23), breech or other malpresentation successfully converted to cephalic presentation, delivered (652.11), breech presentation without mention of version, unspecified as to episode of care (652.20). Procedure codes include: PR anesthesia antepartum manipulation (01958); anesthesia antepartum head manipulation (59412), external version (59412), PR anesthesia antepartum manipulation (01958). The exclusion criteria were: preterm gestation, multi-fetal gestation, abnormal placentation, and rupture of membranes. Manual chart review of the electronic medical record was performed to identify use of nitrous oxide during ECV procedure, successful in conversion to cephalic presentation, and mode of delivery. The primary outcome was successful conversion to cephalic presentation and the secondary outcome was vaginal delivery. Prenatal characteristics collected included maternal age, gestational age at ECV, body mass index, parity, and fetal birthweight. Women were consented prior to procedure and instructed not to eat at least 8 hours prior to the procedure. All women were offered the option of ECV under nitrous oxide prior to the procedure and the use of nitrous oxide was based on the patient's preference. Women in the nitrous oxide group inhaled nitrous oxide in a 50:50 mix with oxygen that was patient controlled and administered by an anesthesia provider present. A tocolytic, terbutaline, was administered to all women within 30 minutes prior to the procedure. Fetal heart tracing was used to monitor fetal status and ultrasound was used to confirm fetal position before and after the procedure. Women in the control group did not use nitrous oxide or any other form of anesthesia or analgesia during the procedure. Complications associated with ECV examined include: placenta abruption, cord prolapse, hemorrhage and fetal demise. Severe maternal complications secondary to nitrous oxide inhalation include: respiratory distress, seizures, and maternal mortality.

The number of women with successful conversion to cephalic presentation and spontaneous vaginal delivery

after ECV were compared between the group that utilized nitrous oxide and the group that did not utilize nitrous oxide. Differences between treatment groups were compared using the independent samples t-test or Wilcoxon rank sum as appropriate. Categorical variables were compared by chi-square. Logistic regression was performed to test whether nitrous oxide was associated with successful conversion to cephalic presentation. Potential confounders maternal age, gestational age, parity, pre-pregnancy BMI, and birthweight were examined for association with ECV through bivariate analysis and retained in the final model if $p<0.02$. Pre-pregnancy BMI did not meet this criterion and was excluded from the final model. All analyses were performed using SAS ver 9.4 (SAS Institute, Cary, NC, USA). This study was approved by the Institutional Review Board of the University of California San Francisco (UCSF).

Results

During the study period, 167 women underwent ECV: 77 women with the use of nitrous oxide and 90 women without the use of nitrous oxide. Of the 77 women who underwent ECV with nitrous oxide, 25 (32.5%) women were successfully converted to cephalic presentation and 17 of these women delivered vaginally (68%) (¿Fig. 1). Of the 90 women who underwent ECV without nitrous oxide, 29 (32.2%) women were successfully converted to cephalic presentation and 21 of these women delivered vaginally (72%).

Clinical characteristics of the participants are presented in Table 1. Groups exposed to nitrous oxide and without exposure to nitrous oxide had similar parity, median gestational age at ECV (37.3 weeks versus 37.3 weeks), median pre-pregnancy body mass index (21.9 kg/m^2 versus 22.9 kg/m^2), and median birthweight (3.2 kg versus 3.3 kg). After controlling for confounders, nitrous oxide was not associated with higher conversion to cephalic presentation (adjusted odds ratio [aOR] 1.08, 95% CI 0.52-2.23). Successful conversion to cephalic presentation was more likely when ECV was performed later in the pregnancy (OR 2.26), in women who were nulliparous (OR 3.33) and for higher estimate fetal weight (OR 1.11) (¿Table 2). Higher maternal age was associated with successful conversion on bivariate analysis, but this did not persist after covariate adjustment.

There were no significant differences in the rate of complications associated with ECV in the rate of emergent cesarean sections or adverse perinatal outcomes: placenta abruption, cord prolapse, hemorrhage and fetal demise. Furthermore, there were no severe maternal complications secondary to nitrous oxide inhalation.

Discussion

Main findings

Our study compared women with cephalic presentation underdoing ECV with the use of nitrous oxide and without the use of nitrous oxide. Our findings show that nitrous oxide was not associated with improved success to conversion to cephalic presentation. As expected, we report a high rate of spontaneous vaginal delivery, nearly 72% and 68% in women who had successful ECV in the nitrous oxide group and the without nitrous oxide group respectively. There was also a low rate of complications of approximately <1% that was consistent with previous reports 11-12 .

This data contributes to the understanding of analgesia use in ECV, particularly nitrous oxide. This may further support that analgesia does not contribute to adverse outcomes secondary to potentially increased provider pressure during the procedure. Our data reinforces that nitrous oxide has a safe profile as there were no severe maternal or fetal complications.

Strength and Limitations

In interpretation of the findings of this study, there are some important considerations. The data on nitrous oxide use in ECV is limited. There are a few studies which showed that the use of nitrous oxide in ECV did not show a difference in success rate in conversion to cephalic presentation compared to without nitrous oxide13,14. While our study is retrospective, it is one of the few studies in the literature. Furthermore, this study was conducted at a single, tertiary care center, which may limit its generalizability. However, the major strength of this study is that both groups were well matched in terms of possible confounders. Additionally,

both cohorts of women had a mean age of thirty-three and mainly nulliparous which may generalize well to institutions with similar populations. We acknowledge that our success rate differs from reported success rate of up to 50-60%, 3, 14. This may be due to the larger number of nulliparous women in both cohorts (79.2% with nitrous oxide vs 78.9% without nitrous oxide) which may contribute to a lower success rate. Nulliparity has been more often associated with unsuccessful ECV 16-18. However, if successfully converted to cephalic, the majority of these women are more likely to have vaginal delivery in both cohorts, 72% with nitrous oxide versus 68% without nitrous oxide. The ACOG encourages ECV as the first-line approach in pregnancies as an effective preventive tool for breech indicated cesarean deliveries; however, only approximately 70% of eligible women are offered ECV3. Therefore, improved utilization of this technique may provide greater opportunities to lower the rate of cesarean deliveries. While nitrous oxide does not seem to improve the success rate, it may be an effective mechanism for pain control which would allow more women to participate in the procedure. Due to its safety profile, providers may consider offering nitrous oxide as a method for pain management for candidates contemplating ECV. While safe, nitrous oxide is currently not as widely available in many facilities. This may be due to the lack of anesthesia personnel, facility requirements, or inexperience. Cesarean delivery is a reasonable mode of delivery for cephalic pregnancies; however, cesarean delivery incurs a higher risk of maternal morbidity. Therefore, external cephalic version may be a useful option particularly in low resourced settings where vaginal breech delivery or cesarean delivery may not be available or safe.

Interpretations

The decision to undergo external cephalic version may be difficult for many women. In a study performed by Nassar et. al. in 2007 which assessed women's informed decision making after randomized to a decision aid, a workbook detailing risk and benefits, versus control, women who received the decision aid had 74% intention to undergo ECV versus 64% in the control group. The cohort with additional information via the workbook report lower decisional conflict, increased knowledge, and greater satisfaction with their decision. Importantly, for women where pain control is a major deterrent for ECV, the availability of nitrous oxide may significantly impact women's willingness to attempt the procedure. Lastly, ECV has been an underutilized technique to combat the rising rates of cesarean delivery and maternal morbidity and mortality. Moreover, this may be a critical area to target for the prevention of primary cesarean deliveries as these women are more than 90% likely to have repeat cesarean deliveries in subsequent pregnancies. Lastly, nitrous oxide may be able to offer another safe option for pain control for women in an area where the options are limited. However, further studies are needed to examine the impact of analgesia on women's decision to undergo ECV.

Conclusion

In summary, our study shows that use of inhaled nitrous oxide during ECV is not associated with improved success in conversion to cephalic presentation when compared to without use of nitrous oxide. We highlight that while ECV remains an important modality for preventing cesarean delivery in pregnancies with malpresentation, it is important to inform women that the use of nitrous oxide does not seem to independently improve conversion to cephalic presentation.

Disclosure of interests

The authors have no conflicts of interests to disclose. Completed disclosure of interest forms are available to view as online supporting information

Contribution to authorship

This study was designed, directed and coordinated by T.H. and M.R. Data analysis was performed by C.B. The manuscript was written by T.H. and R.L. and commented by all authors.

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Details of ethics approval

This study was approved by the Institutional Review Board of the University of California San Francisco number T17-2289, reference number 196744 from 8/16/2017 to 8/16/2016

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