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ORIGINAL ARTICLE

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Impact of a third stage of labor oxytocin protocol on cesarean delivery outcomes

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ABSTRACT
Background: There are currently no standard recommendations regarding the dose, rate, or duration of intravenous oxytocin administration for the active management of the third stage of labor in the USA. In 2008, we initiated a standardized postpartum oxytocin protocol for active management of the third stage of labor. In cesarean deliveries, upon clamping of the umbilical cord, an oxytocin infusion of 18 U/h was started and adjusted upward if there was ongoing uterine atony. The aim of this study was to compare intraoperative data on oxytocin dose, estimated blood loss, supplemental uterotonic use and vasopressor use before and after the implementation of this protocol. We hypothesized that implementation of the protocol would result in lower intraoperative oxytocin doses without increasing estimated blood loss.
Methods: In this retrospective study, patient characteristics, estimated blood loss, vasopressor administration, and supplemental uterotonic use during two time periods were compared: the two-month interval before initiation of the oxytocin protocol and the two-month interval after initiation. Data were compared using the chi-squared test, t-test, or Mann-Whitney U test as appropriate. $P < 0.05$ was considered significant.
Results: Data for 901 deliveries were analyzed. The amount of intraoperative oxytocin administered decreased after implementation of the protocol (median difference 8.4 U, 95% CI 7.4 to 9.4). Although there was an increase in estimated blood loss, there were no differences in the percentage of patients experiencing intraoperative blood loss >1000 mL or the need for additional uterotonic mediations between the two time periods.
Conclusions: We found that the use of an oxytocin management protocol reduced the amount of intraoperative oxytocin administered without increasing the rate of postpartum hemorrhage or the need for additional uterotonics. Clinicians may consider using a rate of 18 U/h as a starting point for administration of oxytocin to achieve adequate uterine tone in healthy parturients for prevention of postpartum hemorrhage.

Keywords: Cesarean delivery; Oxytocin; Protocol; Patient safety; Uterotonic administration

Introduction

Oxytocin is the primary agent administered after delivery to prevent postpartum hemorrhage (PPH) in the obstetric setting, yet the dose and optimal method of delivery remain controversial.[1–4] In many settings, oxytocin is administered as an intravenous bolus or infusion; and the dose is often increased in the setting of PPH. Oxytocin is not benign, and is associated with undesirable cardiovascular effects such as hypotension, tachycardia, chest pain, shortness of breath, and electrocardiogram changes suggestive of myocardial ischemia.[5,6] Bolus-dose oxytocin has been implicated as a direct cause of maternal death.[7] Thus, recent attention has focused on finding the lowest effective dose of oxytocin that minimizes adverse maternal outcomes.[1–4]

There is consistent evidence that active management of the third stage of labor with prophylactic administration of oxytocin reduces bleeding complications, without increasing adverse outcomes, such as retained placenta.[8–10] Historically, at Northwestern Memorial Hospital, patients undergoing cesarean delivery had a free-flowing oxytocin infusion initiated after delivery. The concentration could be increased in the setting of ongoing uterine atony. However, the timing of initiation, and rate of oxytocin delivery were not standardized. Furthermore, a more concentrated oxytocin infusion bag was available for use in induction and

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augmentation of labor, thus, concern for medication error existed.

Approximately 30% of all prescribing errors with potentially adverse outcomes are due to dosing errors.[11] In 2007 the Institute for Safe Medication Practices issued a safety alert recommending that hospitals standardize the concentration of medications, as well as use infusion pumps for all medication infusions.[11] Therefore, in 2008, a decision was made at our institution to implement a postpartum oxytocin protocol for the active management of the third stage of labor. This protocol was developed by a multidisciplinary team of obstetricians, anesthesiologists, pharmacists, and nurses as part of an obstetric safety initiative. The protocol standardized the concentration of oxytocin available across the labor and delivery unit, and specified that oxytocin infusions should be started at a rate of 18 U/h after umbilical cord clamping. The purpose of this study was to evaluate the effect of this protocol on intraoperative oxytocin use, supplemental uterotonic use, estimated blood loss, and post-delivery vasopressor administration in cesarean deliveries. We hypothesized that implementation of the protocol would result in less intraoperative oxytocin use without increasing blood loss.

Methods

This retrospective study was approved by the Northwestern University Institutional Review Board. The Obstetrical Anesthesiology Database was queried to identify all parturients who underwent cesarean delivery under neuraxial anesthesia during two time periods: a two-month interval before initiation of the oxytocin management protocol (September 15, 2008 to November 15, 2008), and a two-month interval after initiation of the protocol (November 20, 2008 to January 20, 2009). Parturients who delivered under general anesthesia or for whom oxytocin data were not available were excluded from the study.

Before initiation of the protocol, following umbilical cord clamping or after delivery of the infant, a free-flowing infusion of oxytocin (10 IU in 0.9% saline 500 mL) was started through a 16- or 18-gauge intravenous catheter. If uterine atony was diagnosed by the obstetrician, the concentration of the infusion could be doubled. The rate and total volume of oxytocin infused were at the anesthesiologists' discretion. The oxytocin infusion was continued until patient transfer to the recovery room, and typically patients would receive approximately 20 IU oxytocin (two 500 mL bags). On November 18, 2008 the postpartum oxytocin protocol for the active management of the third-stage of labor was initiated (Appendix A). Briefly, after delivery and umbilical cord clamping, an infusion of oxytocin (30 U in 0.9% saline 500 mL) was started at a rate of 18 U/h for one hour. In the setting of atony, or at the request of the obstetrician, the rate could be doubled to 36 U/h. If the atony persisted, additional uterotonics were administered at the discretion of the obstetrician and attending anesthesiologist. After completion of the first hour of infusion, a maintenance infusion of 3.6 U/h was continued until discharge to the postpartum unit. Management of hypotension was at the discretion of the anesthesiologist. At the time of this study, all vasopressors were delivered via physician-delivered boluses.

Data were collected by review of the electronic and paper medical records using a standardized data collection form. These data included demographic and obstetric characteristics: age, parity, primary or repeat cesarean delivery, and presence of risk factors for uterine atony or PPH. Risk factors for uterine atony included: protracted labor (arrest of dilation or of descent), fetal macrosomia, multiple gestation, patients receiving magnesium therapy for treatment of preeclampsia, and clinically diagnosed chorioamnionitis.[12] Additional risk factors for hemorrhage collected included: preeclampsia, hemolysis, elevated liver enzymes and low platelet count (HELLP) syndrome, >1 previous cesarean deliveries, placental abruption, uterine myoma, cervical laceration during attempted vaginal delivery, anticoagulation, previous classical uterine incision cesarean delivery, placenta previa, failed trial of labor after cesarean, gestational diabetes mellitus, gestational thrombocytopenia, grand multiparity, polyhydramnios, and history of previous PPH or uterine rupture. The total amount of intraoperative oxytocin and visually estimated blood loss were recorded. The percentage of patients who experienced intraoperative hemorrhage >1000 mL was also recorded. The number of patients requiring intraoperative additional uterotonic or vasopressor medications, as well as the total amount of each drug, was recorded.

Statistical analysis

Descriptive statistics were used to summarize demographic, obstetric, and intraoperative data. Data are presented as mean ± standard deviation (SD), median [interquartile range (IQR)], and numbers and percentages as appropriate. Normal distribution was assessed using the Shapiro-Wilk test. Categorical data were compared using a chi-squared test and continuous data were compared using a two-tailed t-test or the Mann Whitney U test. The primary outcome was the total amount of intraoperative oxytocin administered. The 95% confidence interval (CI) for the difference in oxytocin use by time period was calculated using rank-based methods using a continuity correction of 0.5 and unequal variances. Data were analyzed using Stata SE (Version 10, College Station, TX, USA). $P < 0.05$ was considered significant.