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RESEARCH

Titration of Intravenous Oxytocin Infusion for Postdate Induction of Labor Across Body Mass Index Groups

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ABSTRACT

Objective: To evaluate whether oxytocin titration for postdate labor induction differs among women who are normal weight, overweight, and obese and whether length of labor and birth method differ by oxytocin titration and body mass index (BMI).

Design: Retrospective cohort study.

Setting: U.S. university-affiliated hospital.

Participants: Of 280 eligible women, 21 were normal weight, 134 were overweight, and 125 were obese at labor admission.

Methods: Data on women who received oxytocin for postdate induction between January 1, 2013 and June 30, 2013 were extracted from medical records. Oxytocin administration and labor outcomes were compared across BMI groups, controlling for potential confounders. Data were analyzed using χ^2, analysis of variance, analysis of covariance, and multiple linear and logistic regression models.

Results: Women who were obese received more oxytocin than women who were overweight in the unadjusted analysis of variance (7.50 units compared with 5.92 units, $p = .031$). Women who were overweight had more minutes between rate changes from initiation to maximum than women who were obese (98.19 minutes compared with 83.39 minutes, $p = .038$). Length of labor increased with BMI ($p = .018$), with a mean length of labor for the normal weight group of 13.96 hours (standard deviation = 8.10); for the overweight group, 16.00 hours (standard deviation = 7.54); and for the obese group, 18.30 hours (standard deviation = 8.65). Cesarean rate increased with BMI ($p = .001$), with 4.8% of normal weight, 33.6% of overweight, and 42.4% of obese women having cesarean births.

Conclusion: Women who were obese and experienced postdate labor induction received more oxytocin than women who were non-obese and had longer length of labor and greater cesarean rates.

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Among the nearly 4 million women who give birth annually in the United States, more than 1 in 5 are obese before pregnancy, and 60% have excessive gestational weight gain (Bodnar, Siega-Riz, Simhan, Himes, & Abrams, 2010; Fisher, Kim, Sharma, Rochat, & Morrow, 2013; Martin, Hamilton, Osterman, Curtin, & Matthews, 2015; Moore Simas et al., 2010). Rates of obesity are greatest among non-Hispanic Black (57.2%) and Hispanic women (46.6%) compared with White women (38.7%; Flegal, Kruszon-Moran, Carroll, Fryar, & Ogden, 2016). Women who are overweight or obese are also at a greater risk to have induction of labor (IOL) for reasons such as being postdate, hypertension, and diabetes than their normal-weight counterparts (Denison, Price, Graham, Wild, & Liston, 2008; Kobayashi & Lim, 2015), and IOL rates for all women are also on the rise. Between 1990 and 2010, IOL rates nearly tripled from 9.5% to 23.4% (Martin et al., 2009; Martin et al., 2012). Women who are morbidly obese are approximately twice as likely to experience IOL, to have prolonged pregnancies, and to require postdate IOL than women who are normal weight (Arrowsmith, Wray, & Quenby, 2011; Bhattacharya, Campbell, Liston, & Bhattacharya, 2007; Denison et al., 2008; Walsh, Foley, & O'Herlihy, 2011).

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Intravenous oxytocin is a high-alert medication, and differences in administration across body mass index groups may result in different in labor outcomes.

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Women who are obese are more likely to experience poor labor outcomes such as longer length of labor (LOL) and cesarean birth (Hilliard, Chauhan, Zhao, & Rankins, 2012; Norman et al., 2012; Poobalan, Aucott, Gurung, Smith, & Bhattacharya, 2009). The average length of the first stage of labor for women who are obese is 0.6 to 2.89 hours longer than for women who are normal weight (Hilliard et al., 2012; Kominiarek et al., 2011; Norman et al., 2012). Longer LOL can be associated with greater incidence of postpartum hemorrhage, and women who are obese are 1.5 to 2 times more likely to experience postpartum hemorrhage than women who are normal weight (Bhattacharya et al., 2007; Zhang, Bricker, Wray, & Quenby, 2007). Women who are obese are 3.5 times more likely to have cesarean birth during the first stage of labor (Zhang et al., 2007) and are at 1.5 to 5 times the risk for unplanned cesarean birth than women who are normal weight (Garabedian, Williams, Pearce, Lain, & Hansen, 2011; Pevzner, Powers, Rayburn, Rumney, & Wing, 2009; Poobalan et al., 2009).

Intravenous oxytocin, the medication most commonly used for IOL, is a high-alert medication (Institute for Safe Medication Practices, 2014). Risks related to oxytocin infusion include tachysystole (more than five uterine contractions in 10 minutes averaged over 30 minutes), fetal heart rate (FHR) category changes, and neonatal acidemia at birth (Heuser et al., 2013; Jonsson, Norden-Lindeberg, Ostlund, & Hanson, 2008; Kunz, Loftus, & Nichols, 2013; Macones, Hankins, Spong, Hauth, & Moore, 2008; Simpson & James, 2008). Safe and effective oxytocin titration is based on FHR and uterine contraction (UC) tracings (American College of Obstetricians and Gynecologists, 2009), commonly obtained using external monitors. However, the use of external monitors to obtain accurate FHR and UC tracings becomes less effective with increasing body mass index (BMI; James & Maher, 2009; Ray, Hildreth, & Esen, 2008). Despite the risks and prevalent use of oxytocin, little is known about the association between oxytocin titration and maternal outcomes across BMI groups.

Current practice regarding oxytocin administration is based on pharmacokinetic studies from two to three decades ago, when investigators did not report BMI (Leake, Weitzman, & Fisher, 1980; Perry et al., 1996; Seitchik, Amico, Robinson, & Castillo, 1984). More recently, researchers evaluated oxytocin requirements across BMI groups and found that oxytocin dosage increases with increasing BMI (Chin, Henry, Holmgren, Varner, & Branch, 2012; Pevzner et al., 2009; Roloff, Peng, Sanchez-Ramos, & Valenzuela, 2015; Soni, Chivan, & Cohen, 2013). Authors of these studies reported overall trends in oxytocin administration, but it remains unknown whether nurses administer oxytocin differently across BMI groups. Additionally, these authors described the use of FHR and UC monitoring in their protocol, but these nursing interventions were not included in their analyses. The current obesity epidemic, the widespread use of oxytocin, and barriers to effective monitoring related to obesity pose a serious risk to women who are obese and to their infants. Studies are needed to comprehensively examine oxytocin titration practices, interventions related to oxytocin titration, and labor outcomes across BMI groups.

The first aim of our study was to determine whether titration of intravenous oxytocin infusion for postdate IOL differed among normal weight, overweight, and obese women, controlling for maternal characteristics, labor interventions, and provider type. The second aim was to determine whether labor outcomes (LOL, and method of birth) for women who underwent postdate IOL differed by (a) titration of oxytocin infusion, controlling for the previously stated variables, and (b) titration of oxytocin infusion by BMI group, controlling for the previously stated variables.

Methods

Setting and Sample

This retrospective cohort study included women who gave birth after IOL between January 1, 2013 and June 30, 2013 at a large Midwestern U.S., university-affiliated medical center. Obstetrician-gynecologists and certified nurse-midwives (CNMs) have privileges to practice, and obstetric medical residents manage the labor care of their clinic patients in conjunction with attending obstetrician-gynecologists. The policy at the study site dictates that the infusion be set to titrate at 1 to 2 milliunits/minute by infusion pump and may be increased every 15 to 30 minutes at the discretion of the nurse or obstetric provider. The rate must be decreased if signs of fetal