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RESEARCH

Are Women With Threatened Preterm Labor More Dehydrated Than Women Without It?

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ABSTRACT

Objective: To determine if women who present to the labor and delivery unit at 23 0/7 to 36 6/7 weeks gestation with threatened preterm labor (TPTL) are more likely to be dehydrated than women who present at the same gestational age for other reasons.

Design: Retrospective cohort study.

Setting: An academic medical center in the northeastern United States.

Participants: All women at preterm gestational ages 23 0/7 to 36 6/7 weeks who presented to the labor and delivery unit for care in 2014.

Methods: We compared hydration status by urine specific gravity of women with TPTL to that of women with other chief complaints. Women for whom data were missing and those with hypertension, diabetes, renal disease, vaginal bleeding, ruptured membranes, advanced dilation (>3 cm), multiple gestation, or fetal demise were excluded. Chi-square statistic and a receiver operating characteristic (ROC) curve were used for data analysis.

Results: A total of 840 women at 23 0/7 to 36 6/7 weeks gestation presented during the study period; 188 of these had TPTL, 261 had other chief complaints, and 391 were excluded. The proportion of women diagnosed with dehydration was similar between those with TPTL (39%) and those with other complaints (46%, $p = .12$). An ROC curve showed no association between TPTL and hydration status (area under the curve = 0.57, 95% confidence interval [0.46, 0.67]).

Conclusion: At 23 0/7 to 36 6/7 weeks gestation, the hydration status of women with TPTL was not different from those without TPTL. Because there is no relationship, it is unlikely that hydration is a worthwhile therapy for women with TPTL, although additional prospective study is warranted.

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In 2016, preterm birth occurred in approximately 9.85% of pregnancies (Martin, Hamilton, Osterman, Driscoll, & Drake, 2018). It is a leading cause of neonatal morbidity, mortality, and long-term neurodevelopmental handicap and incurs significant overall health care costs and burden on society (Gyamfi-Bannerman & Ananth, 2014). In 2005, the estimated cost of preterm birth in the United States was greater than $26 billion (Institute of Medicine, 2007). Consequently, prevention of preterm birth is a leading health care priority. Unfortunately, despite years of research and investment in attempts to prevent preterm birth, the overall preterm birth rate in the United States is still hovering around 10% (Martin et al., 2018). Physicians, nurses, and midwives are often faced with the problem of what to do when a pregnant woman presents with threatened preterm labor (TPTL), defined as regular, painful contractions before 37 completed weeks gestation. Tocolytic therapy was previously thought to be the appropriate treatment, but accumulated data showed that tocolytic therapy does not significantly prolong pregnancy or improve perinatal outcome (American College of Obstetricians and Gynecologists, 2016).

A therapy often used in the United States as a first-line treatment for women who present with regular, painful contractions is intravenous (IV) hydration (Stan, Boulvain, Pfister, & Hirsbrunner-Almagbaly, 2013). It has been argued that IV hydration may arrest preterm labor by suppressing anti-diuretic hormone (ADH). It was postulated that dehydration leads to release of ADH (Viero et al., 2010), which provokes uterine

contractions because of its biochemical similarity to oxytocin. Oxytocin and ADH are nonapeptides produced in the hypothalamus and secreted from the posterior pituitary. These two hormones differ only in the positions of two amino acids and hence have similar biochemical activity (Viero et al., 2010). Thus, ADH has some oxytocic properties and can stimulate uterine contractions (Stan et al., 2013). The theory that IV hydration is effective to stop uterine contractions is based on the premise that the hydration suppresses ADH release and hence stops contractions and on the assumption that women with uterine contractions are more dehydrated than those without contractions. However, this hypothesis has not been supported by the available evidence. It should also be noted that the prevalence of tocolytic-associated pulmonary edema is greater in the United States than in other countries (Tuffnell et al., 2005), likely secondary to the more frequent use of IV hydration in the United States.

Ideally, one would measure ADH levels before treatment and compare these levels between women with TPTL and those without it. However, ADH is technically difficult to measure, is produced in a pulsatile fashion, and has a short half-life. Therefore, we decided to use urine specific gravity (USG) as a proxy for hydration status. USG has been widely used as a marker for hydration status in the nutritional and exercise literature and has been shown to be an effective, accurate, and reliable marker (Sommerfield et al., 2016; Zubac, Antelj, Olujic, Ivancev, & Morrison, 2017).

Our objective was to determine whether women who present to the labor and delivery unit at 23 0/7 to 36 6/7weeks gestation with painful, regular contractions (defined as TPTL) are more likely to be dehydrated than those who present at the same gestational ages for other reasons.

Methods

After approval from the Atlantic Health System Institutional Review Board, we carried out a retrospective cohort study of the electronic medical records (EMRs) of all women at preterm gestational ages 23 0/7 to 36 6/7 weeks who presented for care at the labor and delivery unit of an academic medical center in 2014. We applied inclusion and exclusion criteria during review of the EMRs. Women with medical conditions that could affect their USG (such as diabetes, preeclampsia, hypertension, vaginal bleeding, bacteriuria, ruptured membranes, and renal disease) and those with missing outcomes or incomplete information were excluded. Also excluded were those with advanced cervical dilation (>3 cm), multiple gestation, fetal anomalies, and fetal demise. We compared all women who presented with TPTL versus those who presented for other reasons such as acute illness or decreased fetal movement. We defined TPTL as a chief complaint of contractions in the absence of cervical change. Other authors have called this phenomenon *preterm contractions* (Naik Gaunekar, Raman, Bain, & Crowther, 2013).

Despite little evidence, hydration continues to be a common therapy for women with preterm contractions.

Urinalysis is routinely performed on all women at our labor and delivery unit at the point of entry to triage before an IV line or any other therapy is started. The routine urinalysis is a computerized analysis and includes glucose, protein, ketones, leukocyte esterase, and USG. We defined dehydration as a USG $\geq$ 1.020, a commonly used threshold (Baron, Courbebaisse, Lepicard, & Friedlander, 2014; Phillips, Sykes, & Gibson, 2014; Viero et al., 2010). USG was measured from a dipstick of a urine specimen and digitally interpreted. The numeric value was entered into the EMR. Comparisons of USG were made between women with TPTL and those without TPTL.

Demographic differences between the TPTL and no-TPTL outcome groups were compared with the use of chi-square tests for categoric variables. Continuous variables were tested for normality with the Shapiro–Wilk test and then compared with two-sample *t* tests or Mann–Whitney *U* tests. Two types of analysis were performed to compare the primary exposure and outcome. A chi-square analysis was used when USG was categorized into dehydrated or not and then compared with TPTL. Because of the limited post hoc power of the chi-square analysis, a receiver operating characteristic (ROC) analysis was used to compare the outcome of TPTL to USG as a continuous variable.

Results

We reviewed the records of 840 women who were considered eligible for this study. Of these, 391 were excluded on the basis of predefined exclusion criteria. Of the remaining 449, 188 women presented with a chief complaint consistent with TPTL (cases). The other 261 women (control group) had other chief complaints (see Figure 1). There were no significant demographic

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