Original Review

Clinicians' Guide to the Use of Oxytocin for Labor Induction and Augmentation

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Oxytocin is commonly used in obstetrics for labor induction and augmentation. Careful assessment of the individual clinical situation based on indications and contraindications is essential to enhancing safe and effective use. Counseling the woman and her partner regarding potential risks and benefits before use is necessary to promote informed consent. At least 39 weeks of gestation is required for elective labor induction. Recent research has shown that deferring elective induction until cervical readiness has been achieved without the use of pharmacologic agents can be beneficial in reducing the risk of cesarean birth associated with elective induction. A conservative physiologic oxytocin protocol for labor induction and augmentation is recommended to minimize the risk of side effects. Although treatment of excessive uterine activity related to oxytocin has not been studied prospectively, several interventions such as maternal repositioning, an intravenous fluid bolus, and discontinuation of the oxytocin infusion are beneficial in returning uterine activity to normal, based on retrospective review of oxytocin-induced tachysystole. Perinatal quality measures from the National Quality Forum and the Joint Commission can be useful in monitoring care related to induction of labor. These include elective births before 39 weeks of pregnancy and cesarean births for low-risk, first-birth mothers.
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INTRODUCTION

Oxytocin is derived from the Greek words ωκνξ, τοκοχξ, meaning swift birth.[1] It was discovered in 1906 by Sir Henry Dale during animal research when he found that extracts of the human pituitary gland caused contractions of the pregnant uterus.[1] Oxytocin was the first peptide hormone to be sequenced and synthesized.[1] Vincent du Vigneaud was credited with this achievement in 1953 and was awarded the Nobel Prize in chemistry in 1955. Over the years, there has been ongoing study of the pharmacodynamics and pharmacokinetics of oxytocin. Physiopharmacologic research has revealed numerous physiologic and pathologic functions of oxytocin, including effects on sexual activity, penile erection, ejaculation, pregnancy, uterine contraction, milk ejection, maternal behavior, osteoporosis, diabetes, cancer, social bonding, and stress.[1]

Synthetic or artificial oxytocin is commonly used in obstetrics for labor induction and augmentation. In 2007, the last year for which data are available, the rate of induction of labor was 22.8% of all US births.[2] This rate has increased 140% since 1990, when the rate was 9.5%.[2] After birth of the placenta, oxytocin is given to enhance uterine contraction and to minimize the risk of excessive bleeding. It is also the first-line medication used to treat postpartum hemorrhage in the United States.[3] This article reviews the pharmacodynamics and pharmacokinetics of oxytocin and includes recommendations for safe and effective use in obstetrics. Indications and contraindications for use of oxytocin for labor induction and augmentation, treatment of side effects, and risk management strategies applicable to contemporary clinical practice are presented.

PHARMACODYNAMICS AND PHARMACOKINETICS OF OXYTOCIN

The supraoptic and paraventricular nuclei of the hypothalamus produce endogenous oxytocin, which is then carried to the posterior lobe of the pituitary gland where it is released into maternal circulation. This release is triggered by multiple physiologic stimuli including vaginal and cervical stretching. One of the effects of oxytocin is uterine contractions. This effect increases as pregnancy advances to term when there are adequate oxytocin receptors in the uterus.[1] Oxytocin circulates in the blood as a free 9-amino-acid peptide.[4] Plasma clearance of oxytocin is through the maternal kidneys and liver. The maternal metabolic clearance rate of oxytocin in pregnancy at term is 19 to 21 mL per kg per minute.[4] Synthetic or artificial oxytocin used to induce or augment labor is chemically and physiologically identical to endogenous oxytocin; however, the route of administration is different. Endogenous oxytocin is released from the maternal posterior pituitary gland in a natural, pulsatile fashion, whereas exogenous or artificial oxytocin is administered via a continuous intravenous (IV) infusion.[5] With artificial oxytocin, there is the potential for administering more than is needed for normal labor progress as well as the risk of associated side effects.[1,4,5]

Maternal circulating concentrations of endogenous oxytocin during the first stage of spontaneous labor are similar to the effects of a continuous infusion of exogenous oxytocin at 2 to 4 mU per minute.[6] Fetal secretion of oxytocin during labor is at levels similar to an infusion of oxytocin of approximately 3 mU per minute.[7] The combined effects of maternal-fetal contribution to maternal plasma oxytocin concentration are approximately 5 to 7 mU per minute.[8] Thus, there is a baseline maternal plasma concentration of endogenous oxytocin during labor; artificial oxytocin administered for labor stimulation has an additional cumulative effect on plasma concentration and subsequently on uterine contractions.

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Oxytocin concentration and saturation follow first-order kinetics, with a progressive, linear, stepwise increase with each increase in the infusion rate.[9] The biologic half-life of oxytocin is between 10 and 12 minutes.[9,10] Three to 4 half-lives of oxytocin are generally needed to reach a steady-state plasma concentration. The uterine response to oxytocin usually occurs within 3 to 5 minutes of IV administration. These data have important clinical implications because they are the basis for a physiologic approach to a dosing regimen when oxytocin is being used for labor induction and augmentation. Based on the time frame for reaching steady-state plasma concentration, it is best to wait to evaluate the full effects of oxytocin on the uterus before increasing the rate further. Oxytocin rate increases at shorter intervals than every 30 to 40 minutes predispose the woman to excessive doses of oxytocin with associated side effects such as dysfunctional uterine activity and/or tachysystole.[11]

INDICATIONS FOR USE OF OXYTOCIN

Labor Induction

According to the American College of Obstetricians and Gynecologists (ACOG),[12] "Induction of labor has merit as a therapeutic option when the benefits of expeditious birth outweigh the risks of continuing the pregnancy. The benefits of labor induction must be weighed against the potential maternal and fetal risks associated with the procedure." This is a sound recommendation. For the healthy mother and fetus, awaiting spontaneous labor avoids the risks of induction and all of the associated potentially unnecessary interventions. Indications should consider the condition of the mother and fetus, gestational age, and cervical status. Table 1 lists indications and contraindications for labor induction and augmentation as noted by ACOG.[12,13]

A discussion with the woman and her partner should occur before the procedure to promote informed consent. This discussion should include potential risks and benefits, methods and pharmacologic agents that will be used, estimated length of labor, and what may happen if the induction is not successful. Nulliparous women with an unripe cervix should be aware of a 2-fold risk of cesarean birth associated with induction of labor.[12]

Women are interested in knowing potential complications of labor induction. In the most recent *Listening to Mothers Survey*,[14] nearly all first-time mothers surveyed wanted to know every complication (74.7%) or most complications (24%) of labor induction. Adequate education regarding potential risks of elective induction may be useful in encouraging women to await spontaneous labor.[15] Although there is some concern that requests by pregnant women to have labor induced electively are a major reason for the steady increase in elective induction in the United States, in a recent study of over 3300 nulliparous women, 70% were offered the option of elective induction by their obstetricians; this discussion occurred in most cases before the estimated date of birth.[15] It is possible that women perceive the offer of elective induction by their obstetricians as a recommendation. In this study, women who were offered the option of elective induction by their obstetricians were significantly more likely to have an elective induction. However, 63% of women who chose not to have an elective induction indicated that information about risks of the procedures presented in prepared childbirth classes was a factor in their choices.[15]

Timing of elective induction relative to cervical status is important to enhance the likelihood of success and minimize the risk of cesarean birth.[16,17] Recent research[17−19] has shown that deferring elective induction until cervical readiness (eg, a Bishop score of $\geq$ 8 for nulliparous women; $\geq$ 6 for multiparous women) has been achieved without the use of pharmacologic agents can be beneficial in reducing the risk of cesarean birth associated with elective induction. Avoiding a primary cesarean birth is a significant consideration because there is the possibility of placental abnormalities in future pregnancies that may carry a major risk of maternal morbidity,[20,21] and there are fewer clinical settings in which a vaginal birth after cesarean birth is available.[2]

Timing is also critical based on gestational age. Elective inductions should not be performed before completion of 39 weeks of pregnancy.[12] Although there has been recent attention to this issue, it is not new. In 1978, in the first ACOG[22] technical bulletin on induction of labor, clinicians were urged to be cautious: "It is paramount that the iatrogenic birth of a premature infant must be avoided." In 1983, the American Academy of Pediatrics (AAP) and ACOG[23] in their first edition of *Guidelines for Perinatal Care* urged careful assessment of gestational age prior to elective births and recommended 39 completed weeks of gestation as the minimum. This recommendation was initially based on common sense and the opinions of experts; however, over the last several years, supportive evidence of increased risk of neonatal morbidity, admission to the special care nursery or neonatal intensive care nursery (NICU), and longer neonatal lengths of stay when elective births occur too early has been published.[17,24,25] Nevertheless, early term elective births (37/0 wk to 38/6 wk) are still occurring in some US hospitals. Every week is important for fetal growth and development. Neonates born 1 to 2 weeks prior to 39 weeks are at significant risk for morbidity.[17,26] Rates of adverse respiratory outcomes, mechanical ventilation, newborn sepsis, hypoglycemia, admission to the NICU, and hospitalization for at least 5 days are increased 1.8 to 4.2 times for neonates born at 37 weeks' gestation and 1.3 to 2.1 times for neonates born at 38 weeks' gestation.[25] Neonates born even within 3 days before 39 completed weeks have higher morbidity.[25]

Some clinicians have proceeded with early elective births in the context of mature fetal lung testing results. However, the fetal lungs are just 1 organ system that should be fully developed before elective birth, and amniocentesis is not a benign procedure. In 2008, ACOG[27] issued a practice bulletin with recommendations concerning fetal lung maturity. According to ACOG,[27] testing for fetal lung maturity should not be performed and is contraindicated when birth is mandated for fetal or maternal indications. Further, a mature result from a fetal lung maturity test before 39 weeks in the absence of appropriate clinical circumstances is not an indication for elective birth. Recent data indicate that babies with mature fetal lung test results still are at a greater risk of morbidity when born before 39 completed weeks of gestation when compared with neonates born at or after 39 weeks.[28] This supports the ACOG[27] recommendations.

Table 1. Indications and Contraindications for Induction and Augmentation of Labor

Maternal or fetal conditions that may be indications for induction of labor:

- Abruptio placentae
- Chorioamnionitis
- Fetal demise
- Gestational hypertension
- Preeclampsia, eclampsia
- Premature rupture of membranes
- Postterm pregnancy
- Maternal medical conditions (eg, diabetes mellitus, renal disease, chronic pulmonary disease, chronic hypertension, antiphospholipid syndrome)
- Fetal compromise (eg, severe fetal growth restriction, isoimmunization, oligohydramnios)
- Logistic reasons, such as risk of rapid labor, distance from hospital, or psychosocial indications. In such circumstances, at least 1 of the gestational age criteria in the box should be met, or fetal lung maturity should be established. A mature fetal lung test result before 39 weeks' gestation, in the absence of appropriate clinical circumstances, is not an indication for delivery.

Conditions that may be indications for augmentation of labor:

- Spontaneous contractions that have failed to result in progressive cervical dilation or descent of the fetus
- Frequency of contractions is less than 3 contractions per 10 minutes, or the intensity of contractions is less than 25 mm Hg above baseline, or both

Generally, contraindications to labor induction are the same as those for spontaneous labor and vaginal birth including, but not limited to:

- Vasa previa or complete placenta previa
- Transverse fetal lie
- Umbilical cord prolapse
- Previous classical cesarean birth
- Active genital herpes infection
- Previous myomectomy entering the endometrial cavity

Contraindications to augmentation are similar to those for labor induction and may include:

- Placenta or vasa previa
- Umbilical cord presentation
- Prior classical uterine incision
- Active genital herpes infection
- Pelvic structural deformities
- Invasive cervical cancer

Adapted from American College of Obstetricians and Gynecologists.[11,12]

In contrast, for nulliparous women at 41 or greater weeks' gestation, elective induction may be beneficial and does not appear to increase the risk of cesarean birth.[29] The risk of neonatal demise, shoulder dystocia, meconium aspiration syndrome, and severe perineal lacerations may be lower when labor is induced at 41 weeks for nulliparous women when compared with expectant management in this population.[30] These reductions in the risk of adverse outcomes are associated with decreased costs of care.[29,30]

Unit policies and procedures should include prioritization of medically indicated inductions over elective inductions when resources are limited. Elective procedures should not be performed when there are insufficient numbers of nurses to carefully assess maternal-fetal status according to AAP and ACOG[31] criteria. Scheduling elective inductions evenly over

the course of the week rather than all on 1 or 2 days for convenience helps to insure there will be adequate nurse staffing and other resources to safely manage patient care.

Labor Dystocia

Labor dystocia is abnormal labor related to problems with uterine contractions or maternal expulsive forces (powers); problems with fetal position, size, or presentation (passenger); or problems with the pelvis and/or surrounding soft tissues (passage).[13] Augmentation of labor is recommended by ACOG[13] in the context of failure to progress as expected, based on parity and other clinical factors, after careful assessment of maternal-fetal status and determination of the feasibility of successful vaginal birth. Before diagnosing labor

dystocia, the clinician must consider the possibility that the slower than expected progress still falls within the outer limits of normal labor.

Clinical conditions and characteristics of women in labor have changed over the years since the classic study of "normal" labor progress was published by Friedman[32] in 1955. Childbearing women are older and weigh more than in the past. Women today have various associated obstetrical and medical complications not as often seen in 1955. Elective induction against an unripe cervix and with regional analgesia are common. Women with these characteristics were not well-represented in Friedman's study. Bedrest and the limited freedom of movement associated with an IV line and continuous fetal monitoring during labor are additional factors that may have a negative effect on progress. Several recent studies have shown that vaginal birth and a healthy baby can be expected with cervical dilation rates of 0.5 to 1 cm per hour.[33–35] Some women may progress in labor slower than expected yet still remain within normal limits. Therefore, patience and ongoing assessment of maternal-fetal status may be beneficial in avoiding oxytocin for augmentation of longer than expected but otherwise normal labor progression. Women should be counseled regarding potential risks and benefits before augmentation of labor, as they are with labor induction.

Women Attempting Vaginal Birth After Cesarean Birth

Although spontaneous labor without oxytocin augmentation is associated with less risk of uterine rupture for women who would like to have a vaginal birth after a previous cesarean birth (VBAC), in some cases labor induction or augmentation may be necessary for maternal or fetal indications. This issue was one of the areas of evidence reviewed during the National Institutes of Health State of the Science Conference on Vaginal Birth After Cesarean in March 2010.[36] The expert panel concluded that variation among studies with respect to indications for birth, induction protocol, agent and dose, and subsequent use of oxytocin made it challenging to determine an absolute risk of uterine rupture associated with induction for women attempting VBAC.[36] However, some clinical situations associated with increased risk were identified. The risk of uterine rupture in women at term who have labor induced is higher than the risk of rupture if labor starts spontaneously. This risk increases in women whose cervixes are unfavorable at the onset of induction, when induction is performed at more than 40 weeks of pregnancy, and for women without a previous vaginal birth.[36,37] There is a dose-response effect with increasing risk of uterine rupture with higher maximum doses of oxytocin;[38] thus, a cautious approach is recommended.

Successful VBAC is less likely if induction or augmentation is required as compared with VBAC in women at the same number of weeks of pregnancy with spontaneous labor without augmentation.[37] Other predictors of less probability of success include indications for initial cesarean that may be recurrent (eg, labor dystocia), increased maternal age, non-white ethnicity, maternal obesity, preeclampsia, short interpregnancy interval, and increased neonatal birth weight.[37] Induction related to maternal or fetal indications for selected women desiring VBAC is an appropriate option in the context of adequate counseling regarding potential risks and benefits and availability of resources should an emergent situation such as uterine rupture occur.[37]

SIDE EFFECTS OF OXYTOCIN

Minimizing Risks

The most common side effect of artificial oxytocin is excessive uterine activity; however, other types of abnormal uterine activity such as frequent low-intensity contractions and coupling or tripling of contractions also may occur.[39,40] Tachysystole (>5 contractions in 10 minutes, averaged over 30 minutes)[41] can have a progressive negative effect on fetal oxygenation and acid-base status at birth and thus should be avoided.[42–44] A cautious, conservative approach to administration can minimize risk. A standard oxytocin protocol (start at 1 mU/minute and increase by 1-2 mU/minute no more frequently than every 30 minutes, based on the maternal-fetal response) has numerous benefits, including a decreased risk of oxytocin-induced tachysystole, fetal hypoxemia and acidemia, maternal pain, placental abruption, uterine rupture, unnecessary cesarean birth for indeterminate/abnormal fetal heart rate patterns, and postpartum hemorrhage and infection.[12,45–47] Therefore, this standard protocol is recommended as routine safe clinical practice.

Agreement among clinicians on the oxytocin dose and intervals between dosage increases for labor induction is not universal. Some clinicians favor a more aggressive approach, with the intention to speed the labor and birth process. However, the potential shortening of the induction to birth time occurs at the expense of higher rates of tachysystole, fewer spontaneous births, the possibility of a cesarean birth for indeterminate or abnormal fetal status, and an increased risk of maternal morbidity.[46] In the context of normally progressing labor, high-dose oxytocin for induction does not warrant these additional risks, especially as an elective procedure.[5,45,48,49]

When oxytocin is required for labor augmentation following spontaneous active labor, high-dose oxytocin protocols may result in a decrease in the length of labor, a modest decrease in the risk of cesarean birth,[50] and a substantial increase in tachysystole.[51] The authors of a recent systematic review of low-dose versus high-dose oxytocin for labor augmentation estimated that 50 women augmented with high-dose oxytocin would be needed to avoid 1 case of cesarean birth.[50] The 3 randomized controlled trials of active management of labor conducted in the United States found that labor was shortened with this approach, but the rate of cesarean birth was not significantly decreased.[52–54] When considering high-dose oxytocin for labor augmentation, it is important to remember that active management of labor is a "package of care"[55] for nulliparous women that includes strict criteria for admission in spontaneous active labor, no intervention to stimulate labor unless spontaneous labor does not progress normally, amniotomy as the first intervention to augment labor, further observation for normal labor progress, high-dose oxytocin if labor is not progressing after amniotomy, and 1-to-1 continuous bedside attendance by a midwife or labor nurse.[56] Misapplication of the active management of labor protocol by

using aggressive oxytocin induction regimens as the sole component from the original research is inappropriate.[57]

An additional consideration for selecting a physiologic dosing protocol is the status of oxytocin as a high-alert medication.[58] High-alert medications are drugs that have a heightened risk of causing significant patient harm when they are used in error.[39] The Institute for Safe Medication Practices added oxytocin to the list of high-alert medications in 2007. Errors with high-alert medications may or may not be more common than with other drugs; however, patient injury and consequences of associated errors may be more devastating, thus special considerations and precautions are required before and during administration.[58] This may include some or all of the following strategies: improving access to information about these medications; educating clinicians regarding risks; limiting access; using auxiliary labels, automated alerts, and checklists; standardizing ordering, storage, preparation, and administration; and redundancies such as automated or independent double checks when necessary.[58] As with other high-alert medications, standardization and administration of the lowest dose of oxytocin possible to achieve the desired clinical effect is recommended.[49]

When oxytocin is initiated, there is an incremental phase of uterine activity when contractions progressively increase in frequency and strength. Next is a stable phase, during which increases in oxytocin rates will not result in further normal changes in uterine contractions.[39,40] A direct inverse relationship exists between duration and dosage of oxytocin and number of oxytocin receptor sites available for oxytocin uptake during labor.[40,59,60] Continued rate increases over a prolonged period can cause oxytocin receptor desensitization or downregulation, making oxytocin less effective in producing normal uterine contractions. Once active labor is established, oxytocin should be discontinued to avoid receptor downregulation, especially in cases of long labor induction. There are no benefits (eg, shortening labor or decreasing the risk of cesarean birth) to continuing oxytocin after women have progressed to active labor; however, there is more tachysystole when oxytocin continues in this context.[60,61] Prolonged high-dose oxytocin infusions are counterproductive to the augmentation of established labor.[62] Active labor is self-sustaining.[60,61] Extended use and high doses of oxytocin for labor induction and augmentation also increase the risk of postpartum hemorrhage related to uterine atony.[63,64]

Essential aspects of minimizing the risk of oxytocin side effects are physiologic dosing, careful assessment, timely identification, and appropriate treatment. By using the ACOG and AAP[31] recommendations for maternal-fetal assessment every 15 minutes during the active phase of first-stage labor and every 5 minutes during the active pushing phase of second-stage labor for women receiving oxytocin, it is reasonable to expect that any complications will be identified and treated before patient harm occurs.

A tool for evaluating clinicians' responses to oxytocin-induced tachysytole that may be useful for quality improvement has been published elsewhere.[49] The objectives outlined in this tool assume adequate staffing and assessment every 15 minutes, with the goal of identifying tachysystole within 20 minutes of its occurrence, followed by initiation of measures to reduce uterine activity.[49] Treatment should not be delayed until an indeterminate or abnormal fetal heart rate pattern occurs.

Use of checklists that require fetal well-being and normal uterine activity before and during oxytocin administration are beneficial in reducing maximum rates of oxytocin without lengthening labor or increasing operative intervention.[65] The checklist-based protocol for oxytocin infusion based on maternal and fetal response also minimizes the risk of cesarean birth and newborn complications that result in NICU admissions.[65] One-to-one nursing care during labor induction or augmentation is recommended to promote patient safety.[66] Vigilence for signs of uterine atony after birth for women exposed to oxytocin during labor may promote early identification and prompt treatment of hemorrhage.[64] A 2-hour recovery period after both vaginal and cesarean birth, with maternal assessment every 15 minutes, is recommended by AAP and ACOG.[31]

Treatment of Side Effects

Reduction in the oxytocin administration rate or discontinuation until uterine activity returns to normal will usually resolve dysfunctional labor contractions. A 30-minute to 1-hour rest period along with an IV fluid bolus of lactated Ringer's solution often will allow oxytocin receptors to be sensitive to artificial oxytocin and generate uterine contractions that will result in normal uterine activity and labor progress.[4,40,41]

When excessive uterine activity results in an indeterminate or abnormal fetal heart rate pattern, discontinuation of the oxytocin infusion is recommended.[47,67] Ideally, a standard protocol or algorithm for treating excessive uterine activity caused by oxytocin is in place in each hospital and/or health care system. An example is provided in Table 2. Interventions include maternal repositioning, an IV fluid bolus of 500 mL lactated Ringer's solution, reduction in rate or discontinuation of the oxytocin infusion, and terbutaline 0.25 mg subcutaneously if the first interventions are not successful in returning uterine activity to normal. These interventions are consistent with recent recommendations from ACOG (2010) for management of tachysystole during induced or augmented labor.[68] Nurses managing oxytocin administration should be able to initiate this type of protocol without requirements for calling the provider before implementation.[49]

Treatment for oxytocin-induced excessive uterine activity has not been studied prospectively. Retrospective research has found that a combination of interventions is more effective than 1 or 2 interventions. In a recent study,[44] use of 3 interventions (maternal repositioning, an IV fluid bolus of at least 500 mL of lactated Ringer's solution, and discontinuation of oxytocin) resolved the tachysystolic pattern more quickly (6.1 minutes) than 2 interventions (IV fluid bolus and discontinuation of oxytocin, 9.8 minutes) or 1 intervention (discontinuation of oxytocin, 14.2 minutes).

An established plan for prompt identification and treatment of postpartum hemorrhage may be beneficial in reducing the risk of adverse maternal outcomes. The California Maternal Quality Care Collaborative offers a postpartum hemorrhage tool kit to assist perinatal teams with planning for treatment of this obstetric emergency.[3] The tool kit includes protocols, checklists, and management strategies,

Table 2. Suggested Clinical Protocol for Oxytocin-Induced Uterine Tachysystole

Oxytocin-induced tachysystole (normal [category I] FHR)

- Maternal repositioning (either left or right)
- IV fluid bolus of lactated Ringer's solution
- If uterine activity has not returned to normal after 10 min, decrease oxytocin rate by at least half; if uterine activity has not returned to normal after 10 more min, discontinue oxytocin until uterine activity is less than 5 contractions in 10 min.

Oxytocin-induced tachysystole (indeterminate [category II], abnormal [category III] FHR)

- Discontinue oxytocin
- Maternal repositioning (either left or right)
- Intravenous fluid bolus of lactated Ringer's solution
- Consider oxygen at 10 L/min via nonrebreather face mask if the first interventions do not resolve the indeterminate/abnormal FHR pattern. Discontinue as soon as possible.
- If no response, consider 0.25 mg terbutaline subcutaneously
- Notify primary provider of actions taken and maternal-fetal response

Resumption of oxytocin after resolution of tachysystole

- If oxytocin has been discontinued for less than 30 min; the FHR is normal, and contraction frequency, intensity, and duration are normal, resume oxytocin at no more than half the rate that caused the tachysystole and gradually increase the rate as appropriate based on unit protocol and maternal-fetal status. If oxytocin is discontinued for more than 30 min, resume oxytocin at 1 mU/min.

Abbreviations: FHR, fetal heart rate.
Adapted from Simpson.[47]

with an emphasis on early identification based on routine evaluation of estimated blood loss and active management of the third stage of labor.[3]

RISK MANAGEMENT AND PATIENT SAFETY

The focus of successful risk management related to use of oxytocin for labor induction and augmentation is selection of appropriate candidates, accurate assessment of gestational age, avoidance of early term births, counseling the woman regarding potential risks and benefits, informed consent, ongoing maternal-fetal assessment, timely identification of side effects and complications, and timely appropriate intervention. Careful attention to each of these aspects of care can minimize risk.

The National Quality Forum[69] and the Joint Commission[70] have developed perinatal quality measures to monitor appropriate gestational age for elective birth. These measures, along with the AAP and ACOG[31] recommendations for avoiding early elective births have increased public awareness of this issue. Therefore, in addition to risk of iatrogenic prematurity with potential adverse neonatal sequelae, an early elective birth increases the risk of professional liability both for the provider and the health care institution. If a woman having an early elective birth suffers an adverse outcome, and litigation ensues, there is evidence available to the plaintiffs of a breach of the standard of care before any other aspects of the case are reviewed. Avoidance of tachysystole and timely treatment if it occurs are essential to promoting patient safety and decreasing professional liability. Management of oxytocin is a prominent feature in many obstetric malpractice claims.[71−75] Findings of prolonged periods of tachysystole without appropriate clinical intervention can result in a successful claim even if the excessive uterine activity was not a causative factor in patient injury or harm.[74] The National Quality Forum[69] and the Joint Commission[70] quality measures also are applicable to complications of labor induction because cesarean birth for low-risk first-birth mothers is included in the measure set. Cesarean birth is a known risk of elective induction for nulliparous women.[12,75]

SUMMARY

Oxytocin can have benefits for pregnant women when used appropriately. Careful assessment of the clinical situation may lead to the determination that oxytocin is not indicated. Patience and expert clinical judgment when contemplating use of oxytocin is recommended. Knowledge and clinical application of the latest evidence and professional standards and guidelines are essential to promoting patient safety when using oxytocin.

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CONFLICT OF INTEREST

The author has no conflicts of interest to disclose.

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