Induction of labor in the obese patient

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ABSTRACT

Obese women are at an increased risk of antepartum pregnancy complications and are therefore more likely to require an induction of labor than normal weight women. They also have an increased rate of failing an induction of labor, a rate that rises significantly with increasing body mass index, and subsequent surgical and neonatal complications of an intrapartum cesarean delivery. This increase in induction failure may be due to differences in the myometrium of obese women resulting in decreased contraction strength. There have been only a few studies comparing the efficacy of the various cervical ripening agents in obese women and at this point no recommendation can be made as to what method may result in the greatest chance of a successful induction.

Epidemiology of obesity and labor induction

Obesity in the United States is an epidemic that obstetric providers manage daily. As of 2012, more than half, 58.5%, of all women aged 20–39 are either overweight or obese and almost one-third are obese, 31.8%. These rates vary by race and ethnicity with non-Hispanic black women aged 20–39 having the highest rate of obesity, 55.8%, and non-Hispanic Asian women having the lowest rate of obesity, 10.9%. Obese women not only face long-term chronic medical conditions but are also at increased risk of developing maternal and neonatal adverse pregnancy outcomes. An increased body mass index (BMI) is associated with a greater likelihood of developing hypertensive complications during pregnancy, gestational diabetes, a postdate pregnancy and fetal macrosomia, as well as twice the rate of cesarean delivery compared with women with a normal BMI. These conditions often lead to a need for a labor induction as women with gestational diabetes are often delivered by their due date and women who develop hypertensive disorders of pregnancy are recommended to be delivered between 34 and 37 weeks depending on the severity of the disease.

The rate of labor induction rose steadily between the 1990s and 2000s to a peak of 23.8% in 2010, but then dropped to 23.2% in 2012. In obese women this rate is significantly increased and is positively correlated with class of obesity. Wolfe et al. found that 30.4% of women with class I (BMI = 30–34.9 kg/m²) obesity had an induction of labor while 34.0% of women with class III (BMI > 40 kg/m²) obesity required an induction of labor.

Failed labor induction: Rates and outcomes

Unfortunately, obesity is also associated with an increased rate of failed induction requiring a cesarean delivery, specifically for nulliparous obese women. As with the rate of labor induction, the rate of induction failure also increases progressively with increased classes of obesity. Women with class I and II (35–39.9 kg/m²) obesity who underwent an induction of labor required a cesarean delivery 20.2% and 24.2% of the time, respectively, whereas women with a BMI from 40 to 50 kg/m² had a failed induction rate of 31.6% and as high as 63.2% in women with a BMI > 60 kg/m². The rate
of cesarean delivery rose to as high as 77.8% when considering only nulliparous women with a BMI > 60 kg/m². In addition to nulliparity, several additional maternal and fetal factors increase the risk of cesarean delivery after labor induction. Lower cervical dilation at admission, no prior vaginal deliveries, and fetal weight > 4000 g are all significantly associated with an increased likelihood of having a failed labor induction and subsequent cesarean delivery. Maternal age, race, and gestational age at delivery did not impact an obese woman’s rate of requiring a cesarean delivery after induction, whereas multiparity and a Bishop’s score at admission ≥ 5 were associated with a decreased rate of cesarean delivery.

Not only are obese women more likely to have a failed induction of labor but also they are at increased risk of maternal and neonatal complications after their cesarean delivery. Compared with morbidly obese women who had a successful labor induction, after a failed induction of labor, morbidly obese women were 1.5 times more likely to develop chorioamnionitis, 2 times more likely to develop a postpartum infection, and 3.5 times more likely to have operative complications such as postpartum hemorrhage, incisional extension, or injury to a surrounding tissue. The neonates of obese women who fail their labor induction also have 1.5–3 times the rate of morbidity (i.e., requiring respiratory support, antibiotics, and/or transfer to the NICU) of those infants born to normal weight mothers or obese mothers with a successful labor induction. For those obese women who do successfully deliver vaginally after an induction of labor, there is a higher rate of second-degree tearing.

In light of the high rate of failure, as well as maternal and neonatal morbidity associated with a failed labor induction for obese women, there has been consideration for an outright cesarean delivery instead of a labor induction. However, when Subramaniam et al. compared the outcomes for morbidly obese women who underwent labor induction to morbidly obese women who underwent a planned cesarean delivery they found no difference in maternal or neonatal morbidity. In addition to cesarean delivery, consideration has been given to the potential benefit of elective induction at term for obese nulliparous women. However, Wolfe et al. found that this strategy, when compared with expectant management, resulted in an increased risk of cesarean delivery and higher rates of NICU admission. Ultimately, providers must individualize care for morbidly obese women. Recognizing that the rate of labor induction failure for nulliparous women with a BMI > 60 kg/m² may be close to 80% and taking into consideration the significantly increased rates of both maternal and neonatal morbidity after a failed induction, there may be some women in whom a planned cesarean delivery may be appropriate after an informed discussion between the patient and the physician.

### Outcomes of different induction agents in obese women

With such high rates of failure and significant consequences for both the mother and infant, providers would likely be interested in knowing if there are specific labor induction agents or methods that are more likely to result in a vaginal delivery for an obese patient. Unfortunately, there are only a few studies that have specifically compared the outcomes of different induction methods for obese women. Those studies that have investigated the use of specific induction agents have looked at the effect of only medical cervical ripening or induction agents with no studies looking at effect of mechanical induction methods on successful vaginal delivery in obese women.

When using a dinoprostone tampon, obese women were 2.3 times more likely to require a second cervical ripening agent and 2 times more likely to require a cesarean delivery, even after the administration of a second induction agent. Additionally, obese women who received the dinoprostone tampon had labor that lasted 5 h longer than in non-obese women. Additionally, in another study looking at risk factors for a failed induction after the administration of 5 dinoprostone vaginal tablets, maternal BMI > 25 kg/m² along with nulliparity and admission Bishop’s score of <4 was noted to be significantly associated with the need for a cesarean delivery.

In comparing 2 different induction agents specifically in obese women, Suidan et al. compared outcomes for women who received a 10-mg dinoprostone vaginal insert to those who received misoprostol, either 25 μg vaginally or 50 μg orally. They found that even after adjusting for parity, gestational age, birth weight, and indication for induction, obese women who received misoprostol were more likely to have successful cervical ripening and a lower rate of cesarean delivery despite the fact that the women who received misoprostol had a significantly increased birth weight than the women who received dinoprostone. They further compared women who received oral versus vaginal misoprostol and there were no differences in the rates of successful cervical ripening or cesarean delivery. Additionally, there was no difference in the rates of intrapartum complications such as infection and need for emergent cesarean delivery or NICU admission.

While misoprostol appears to be a more effective induction agent than dinoprostone in obese women, there are differences in the labor progression and medication requirements when comparing non-obese to obese women who receive misoprostol. Obese women who receive misoprostol take longer to deliver than non-obese women by up to 4 h for morbidly obese patients. This is in spite of the fact that an obese BMI makes a woman more likely to not achieve active labor and have a cesarean delivery for a failed induction. Additionally, obese and morbidly obese women receiving misoprostol had a higher rate of cesarean delivery for all indications, 29.8% and 36.5%, respectively, than non-obese women receiving misoprostol, 21.3%.

In conjunction with having an increased rate of labor induction failure, obese women have higher utilization of oxytocin than normal weight women. Obese and morbidly obese women who receive misoprostol are more likely to require oxytocin for augmentation of labor, OR = 1.5 and 2.1, respectively, than their non-obese counterparts and to require 1.5–2 times the amount oxytocin for longer time periods, 15–19 h versus 14 h. Even in those women with a successful induction of labor resulting in a vaginal delivery,
obese women require higher maximum doses of oxytocin for longer periods of time than their lean counterparts.\textsuperscript{15}

**Pathophysiology of labor induction in obese women**

Obesity, even after the spontaneous onset of labor, is associated with a prolonged and altered labor curve compared with non-obese women.\textsuperscript{16} Obese women require a longer time period to achieve active 6 cm of dilation, than women with a BMI < 30 kg/m\textsuperscript{2}.\textsuperscript{16} Prolongation of the latent phase is correlated with maternal weight as morbidly obese women require an even longer time to reach 6 cm than those women with class I and II obesity.\textsuperscript{16} This in turn results in longer total length of labor for obese women.\textsuperscript{16} In attempting to determine the reason for the prolonged length of labor in obese women, regardless of induction versus spontaneous labor, differences in hormone levels, receptors, and myometrial contractility have been observed.

One of the leading theories behind the reason for increased rates of postdates pregnancies, prolonged labor courses, and increased rates of cesarean delivery for obese women is differences in the contractile ability of the myometrium of obese women compared with non-obese women. The myometrium of obese women who have not gone into spontaneous labor has been shown to have decreased contractile function than that of normal weight women.\textsuperscript{17} However, despite the decreased contractility found in the myometrium of obese women, there does not appear to be a difference in the number of oxytocin receptors at term in obese versus normal weight women.\textsuperscript{18}

Leptin and cholesterol, 2 additional factors which are produced in higher numbers in obese women, have been proposed for the mechanisms behind the impaired contractility of the obese myometrium. Leptin, which is a hormone produced by adipose tissue and therefore found in higher levels in obese women, has been shown to decrease the influx of calcium ions into uterine smooth muscle.\textsuperscript{19} Elevated levels of cholesterol, which is again more common in obese women than normal weight women, have also been shown to inhibit calcium influx in the myometrium leading to decreased contractility.\textsuperscript{20} The inhibition of calcium influx by both leptin and cholesterol in turn leads to an antagonist effect against oxytocin, which causes myometrial contractions by releasing calcium from intracellular stores.\textsuperscript{17,20} The clinical manifestation of this antagonistic effect is increased rates of postdates pregnancies, dysfunctional and prolonged labor patterns, and an increased rate of cesarean delivery in obese pregnant women.

**Special maternal medical conditions and labor induction in obese women**

Gestational hypertension and preeclampsia occur in approximately 8\% of pregnancies. Obese women are more likely to develop hypertension associated with pregnancy and women who develop gestational hypertension/preeclampsia are more likely to require a labor induction.\textsuperscript{21} When investigating the rates of cesarean delivery in women with preeclampsia who require a labor induction, Robinson et al.\textsuperscript{21} found that obese women had higher rates of cesarean delivery. Specifically, for every 5-unit increase in maternal BMI there is a 16\% increase in the rate odds of requiring a cesarean delivery for women with preeclampsia.\textsuperscript{21}

As with obese women, women carrying twins are at increased risk of pregnancy complications. This in turn results in an elevated rate of labor induction for twin pregnancies.\textsuperscript{22} In comparing the effect of cervical length, body mass index, and Bishop’s score, only an increased BMI was found to be higher in women who failed to achieve the active phase of labor within 24 h of labor induction.\textsuperscript{22} Furthermore, in twin pregnancies, women with a BMI $\geq 30$ kg/m\textsuperscript{2} have an 82\% rate of failing their labor induction within 24 h.\textsuperscript{22}

As obese nulliparous women are more likely to have a failed labor induction resulting in failure and subsequent cesarean delivery, there are a significant number of obese women who are potential candidates for a trial of labor after a cesarean section (TOLAC). Independently, both obesity and induction of labor have been shown to be associated with a decreased chance of successful TOLAC.\textsuperscript{23,24} Prostaglandin agents are contraindicated for women undergoing a TOLAC; however, mechanical agents and oxytocin can be utilized for cervical ripening and labor induction.\textsuperscript{25} When looking specifically at morbidly obese women who had a failed TOLAC, Chauhan et al.\textsuperscript{25} found that 15\% of women had a failed induction requiring cesarean delivery and that none of the women who achieved a vaginal birth after a prior cesarean delivery underwent an induction of labor. When counseling obese women about a TOLAC, providers should be cognizant of the elevated risks of failure if induction is required to start labor and weigh this against the morbidity of an additional surgical procedure.

**Excessive weight gain during pregnancy**

In addition to starting pregnancy with a body mass index $>30$ kg/m\textsuperscript{2}, excessive maternal weight gain has also been found to be associated with an increased rate of labor induction failure.\textsuperscript{26,27} For women with a postdate pregnancy, maternal weight gain above 26 pounds was associated with an 8\% increase in failing their induction by not achieving a vaginal delivery within 24 h of beginning the induction.\textsuperscript{27} Additionally, Gawade et al.\textsuperscript{26} found that for women undergoing labor induction, there is a 13\% increased rate of requiring a cesarean delivery for every 11-pound increase in maternal weight gained and an 8\% increase in risk for cesarean delivery for every 1-unit increase in maternal BMI. While the majority of focus on risk of failed induction is often placed on obese women or those with unfavorable cervical exams, providers should be reminded to discuss weight gain goals throughout pregnancy and to address excessive gestational weight gain when counseling their patients on labor induction.

**Conclusion**

As the majority of women who are of child-bearing age are overweight or obese, discussing labor induction with a
patient with an elevated BMI is likely a regular occurrence for prenatal care providers. While the rate of failed induction for obese and especially morbidly obese women is significant, so too are the consequences of a failed induction. Obstetric providers should make every attempt to increase the success of a labor induction in an obese woman, including being cognizant of the prolonged labor course and elevated required doses of oxytocin, and consider induction with misoprostol rather than dinoprostone. Additionally, all pregnant women should be reminded of the importance of tempered gestational weight gain and counseled on the recommendations of the Institute of Medicine. Finally, in women with extremely morbid obesity and multiple risk factors for failing a trial of labor, there may be a role for individualized counseling and discussion of a planned cesarean delivery.

REFERENCES