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Failed induction of labor

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ABSTRACT

Induction of labor will affect almost a quarter of all pregnancies, but historically there has been no generally accepted definition of failed induction of labor. Only recently have studies analyzed the lengths of latent labor that are associated with successful labor induction ending in a vaginal delivery, and recommendations for uniformity in the diagnosis of failed induction have largely resulted from this data. This review assesses the most recent and inclusive definition for failed induction, risk factors associated with failure, complications, and special populations that may be at risk for a failed induction.

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Introduction

Because 23% of all births in 2013 started with an induction of labor, it is imperative to have a consistent definition of success, and failure, of induced labor.¹ Historically, there has been no generally accepted definition of failed induction of labor, including within the most recent editions of Williams and Gabbe Obstetrics textbooks.^{2,3} The American College of Obstetricians and Gynecologists 2009 practice bulletin on induction of labor does not provide an unequivocal definition, although it does recommend a certain length of time before diagnosing a failed induction.⁴

The rate of labor induction has more than doubled in the United States over the past decade.⁵ Increasing induction rates may be associated, in part, with a rise in elective inductions, although as the pregnant population ages, so does the prevalence of medically necessitated deliveries.⁶ The conventional wisdom of labor induction increasing the risk of cesarean delivery (the endpoint of a failed induction) is now questioned, in large part secondary to the analysis of the randomized clinical trials comparing induction to expectant

management.⁷ In observational trials, cesarean delivery rates are consistently lower in women who have spontaneous labor compared to those who are induced. However, women cannot choose to be in spontaneous labor, so recent analyses have focused on a comparison of expectant management versus induction.⁸ Even with this paradigm shift, some women will experience a failed induction. This review assesses the most recent and inclusive definition for failed induction, risk factors associated with failure, complications, and special populations that may be at risk for a failed induction.

What is a failed induction?

Failed induction has been described several ways in the literature in both observational and randomized trials. Definitions have included failed vaginal delivery,⁹ failed entry into active labor,^{10,11} and failed labor after a certain number of ripening agents.¹² In some trials, no definition was provided in the protocol for failed induction.^{13,14} Due to this lack

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of standardization, even among randomized controlled trials, it is not surprising that the term failed induction has an unclear meaning.

In clinical practice, the decision to proceed with cesarean delivery for failed labor induction is based on non-uniform criteria.¹⁵ In a secondary analysis of the Maternal Fetal Medicine Unit (MFMU) Network multicenter study on fetal pulse oximetry and cesarean, women with a latent phase extending beyond 12 h had a 39.4% vaginal delivery rate.¹¹ The protocol required at least 12 h of oxytocin administration after rupture of membranes, and then considered a failed induction if there was no progress into the active phase of labor. Active phase in this trial was defined as 4 cm dilated and 90% effaced or 5 cm dilated regardless of effacement. This study was consistent with two prior single center studies, showing progressively lower rates of vaginal delivery with longer durations of the latent phase.^{10,16} However, even after 18 h in the latent phase, 64% of women still achieved a vaginal delivery, dropping to 33% after 24 h.¹⁰ In all three studies, failure to exit the latent phase after 12 h of oxytocin and ruptured membranes was uncommon (4–17%).^{10,11,16}

Available data suggest that requiring at least 24 h of oxytocin after membrane rupture prior to declaring a failed induction in the latent phase reasonably balances the maternal benefit of vaginal delivery with maternal risks of chorioamnionitis and uterine atony. Reassuringly, with contemporary management, any fetal or neonatal risks associated with labor induction do not appear to be affected by latent phase duration.¹¹ Additionally, failed induction should be differentiated from arrest disorder in the first stage. The diagnosis of failed induction should be reserved for those women who have not achieved regular (e.g., every 3 min) contractions and cervical change after at least 24 h of oxytocin administration, with artificial membrane rupture if feasible (after completion of cervical ripening, if performed).¹⁷

Labor progression during induction

Until recently, labor progression was typically managed using the labor curves developed by Friedman¹⁸ in the 1950s. However, the modern obstetric population is quite different from Friedman's original group of nulliparous patients. The Safe Labor Consortium analyzed the duration of labor in 62,415 women with a term singleton pregnancy and developed contemporary patterns in labor.¹⁹ Labor in nulliparous women took longer than expected based on the Friedman curves. The investigators found that labor can take more than 6 h to progress from 4 to 5 cm, and more than 3 h to progress from 5 to 6 cm. The median duration of active phase, from 6 cm to complete cervical dilation, was 2.1 h in nulliparous women and 1.5 h in multiparous women, with the 95th percentiles of 8.6 and 7.5 h, respectively. The median and 95th percentiles for the cervical change before 6 cm are similar for nulliparous and multiparous women. This suggests that the historical criteria defining normal labor progress should no longer be applied to the contemporary obstetric population.

As modern data suggest that active labor may not begin until approximately 6 cm dilation, rather than the previously recognized 4 cm cutoff, a diagnosis of an arrest disorder should not be made until 6 cm dilation is reached. Once 6 cm cervical dilation is reached and the active phase is entered, labor progress during induction of labor is similar to the patient in spontaneous labor; however, the duration of the phase before 6 cm dilation is longer in women undergoing induction of labor.²⁰ More than half of induced women remained in the latent phase for 6 h, and nearly one-fifth remain in the latent phase for 12 h or longer.²¹ Also, women who are induced after cervical ripening have a markedly prolonged labor progression from 3 to 4 cm. Women who undergo pre-induction cervical ripening are slower to enter the active phase and have a slower course of labor than those who are induced and do not require cervical ripening agents.²²

Risk factors for failure

An unripe cervix, nulliparity, and obesity are the driving risk factors for a failed induction of labor, though "failure" in these studies is largely defined as not achieving a vaginal delivery.^{23–25} In a retrospective study of over 2000 nulliparous women, either undergoing induction of labor or presenting in spontaneous labor, women who had elective induction with cervical ripening had a significantly longer latent phase and early active phase and a 2–3 fold increased risk of cesarean delivery compared with those with a spontaneous onset of labor. Despite cervical ripening, oxytocin, and a long wait for cervical change, women with an unfavorable cervix had a cesarean delivery rate of 40%.²⁴ This was consistent with findings of earlier studies, which showed a similar increase in cesarean for women with an unripe cervix and who received pre-induction ripening.²⁵ Both nulliparous and multiparous women with an unripe cervix at preterm and at term had lower vaginal delivery rates, compared to those cases with a ripe cervix.²⁶ However, the measure of cervical ripeness, often in the form of a Bishop score, has mixed results when predicting a failed (or successful) induction. A recent systematic review and meta-analysis showed no utility in this practice for Bishop scores of 4, 5, or 6.²⁷ At a Bishop score 5–9, the negative predictive value was 96%, meaning 96% of women would deliver vaginally. However, overall sensitivity to predict a cesarean based on Bishop score ranged from 12 to 100%, with a specificity of 12–95%.²⁷ Conversely, other evidence-based reviews have shown an association with successful induction (measured by vaginal delivery) with high Bishop score.²⁸ The utility of the Bishop score to determine whether to induce now or later is limited, as evidence that expectant management in hopes of achieving a better Bishop score and thus a higher vaginal delivery rate is not present.^{7,8,28,29}

Nulliparity also plays a role as a risk in failed induction. In a retrospective cohort of over 1.2 million women at term, elective induction in multiparous women was associated with a high vaginal delivery rate of 97% versus 76.2% for nulliparas.²⁶ Recent evidence-based reviews have shown in women induced versus expectant management, there is

moderate- to high-quality evidence of increased parity associated with successful labor induction.²⁸

Lastly, obesity has consistently shown to increase risk of failed induction of labor, which appears to have a dose-related response of increasing failure with increased maternal weight.^{23,30–33} Multiple retrospective studies consistently show a cesarean delivery rate of 40% in induced obese women.^{33–35}

Complications of failed induction

In two separate series, postpartum hemorrhage, chorioamnionitis, and endometritis are all associated with the increased length of latent labor.^{10,11} However, only 2 patients in the series of 397 women received transfusions, and no one had an extended hospital stay.¹⁰ There does not appear to be any association with neonatal complication (sepsis, intensive care admission, Apgar <7, cord pH <7) with increasing length of latent labor.^{10,11} Reassuringly, induction of labor decreases the risk of neonatal compromise in comparison to expectant management.^{36–38}

Special considerations

Obesity

Not only is obesity related to an increased risk of failed induction, it has a dose-related response to a successful trial of labor, whether spontaneous or induced.^{30,34} In a recent series of over 600 women by Subramaniam et al., up to 50% of women induced with a BMI > 50 kg/m² had a delivery ending in cesarean. Noting that failed induction rate is high in this particular group of women, it seems reasonable to question whether a planned cesarean would have improved maternal and neonatal outcomes. However, the same authors showed in their adjusted analysis that a planned cesarean provided no benefit to mother or fetus over an induction of labor. A failed induction increased the risks of operative complications, infections, and neonatal composite complications compared to those with either a vaginal delivery or a planned cesarean in this sub-population of obese women.³⁴

As noted earlier, studies comparing induction to expectant management are not expected to increase the overall cesarean rate. However, this may not hold true for the obese parturient. A small retrospective study showed increase in cesarean delivery for those induced compared to expectant management, as well as increased neonatal ICU admissions. However, further studies need to be done to assess this particular risk factor.³⁵

Vaginal delivery after cesarean (VBAC)

Induction of labor in women with previous cesarean remains a controversial topic. As in other studies of failed induction, there is a higher chance of cesarean delivery for those who undergo an induction compared to spontaneous trial of labor after cesarean in contemporary observational trials.^{39,40} In the contemporary control group of expectant management,

Palatnik and Grobman showed that induction increased the chance of VBAC at 39 and 40 weeks, although this increase was statistically significant only in the 39th week. Neonatal complications were not increased in the induction group, but uterine rupture was statistically increased in women who were induced in the 39th week.⁴¹

However, 55–73% of women will achieve a vaginal delivery after an induced TOLAC.^{41–43} This is a large proportion of women that can then avoid the risks and complications of additional repeated cesarean sections. A failed induction in these cases essentially brings the patient to the initial choice of repeat cesarean versus trial of labor. The concern in this population is not so much that they may have a failed induction, but that the failure will significantly increase the maternal and neonatal morbidity.

Harper et al.²¹ suggest that there is no difference in the hazard ratio of uterine rupture for those women induced versus those in spontaneous labor. In this retrospective cohort of patients, 24% were exposed to prostaglandins and one patient had a Foley catheter induction. However, the sub-analysis of time-to-rupture did show that women in spontaneous labor had a lower risk of uterine rupture compared to those induced or augmented, suggesting a component of time as a risk factor in this group. An earlier study by Zelop et al.⁴⁴ did not show an association of time in labor, but rather an increase in uterine rupture for induced patients without a previous vaginal delivery. Grobman et al.³⁹ showed in a large, prospective observational cohort that women with a previous cesarean and a prior vaginal delivery had no increased risk of uterine rupture, and Bujold et al.⁴² showed no statistical difference in uterine rupture between spontaneous labor, induction with amniotomy and oxytocin, and Foley catheter induction in a series of 2479 patients undergoing trial of labor after cesarean.

Preterm induction

A special note on preterm inductions is worth mentioning, since 42% of all preterm deliveries in the United States were indicated and not due to preterm labor.⁴⁵ Successful inductions are possible in this population, even at extreme premature gestational ages. In an analysis of the Safe Labor Consortium data, vaginal delivery was achieved in 57% of pregnancies induced at extreme prematurity (24–27 6/7 weeks). This rate steadily increased with increasing gestational ages, to 77% in the late term population.⁴⁶ Overall, there was no difference in the odds of vaginal delivery between gestational ages 24–33 6/7 weeks, but a significant increase occurred at the 34 week threshold. As in previous studies, age and BMI were minor associations with decreased vaginal delivery rate, as was parity.^{46,47} The data from the Safe Labor Consortium had higher rates of vaginal delivery for premature gestations compared to earlier studies. In a series of 145 women induced with severe preeclampsia remote from term, only 32% of women less than 28 weeks delivered vaginally, which increased to 52% from 28 to 30 weeks gestation.⁴⁸ Additionally, in another series of 189 women with HELLP, there were even lower rates of vaginal delivery before 30 weeks (15%), increasing to 48% in those between 30 and 34 weeks.⁴⁹ These differences may be due to

the nature of this sub-population with a severe maternal indication for delivery. Depending on the indication for delivery and maternal and fetal status, an induction of labor should be offered to preterm patients with appropriate counseling of success rates.

Conclusions

Since the goal of labor induction is vaginal delivery, adequate time to enter into or progress in labor should be allowed, provided mother and neonate remain stable. Longer latent labor times should be allowed for each woman to have a full opportunity to have a safe, successful vaginal delivery. A minimum of 24 h should be allowed after cervical ripening and oxytocin administration (optimally with membranes ruptured) prior to diagnosing a failed induction. And although the likelihood of vaginal delivery dramatically decreases after this point, in a properly selected and counseled patient this minimum time period may be extended in an effort to avoid failure.

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