OBSTETRICS

Defining failed induction of labor

William A. Grobman, MD, MBA; Jennifer Bailit, MD, MPH; Yinglei Lai, PhD; Uma M. Reddy, MD, MPH; Ronald J. Wapner, MD; Michael W. Varner, MD; John M. Thorp Jr, MD; Kenneth J. Leveno, MD; Steve N. Caritis, MD; Mona Prasad, DO; Alan T. N. Tita, MD, PhD; George Saade, MD; Yoram Sorokin, MD; Dwight J. Rouse, MD; Sean C. Blackwell, MD; Jorge E. Tolosa, MD, MSCE; for the *Eunice Kennedy Shriver* National Institute of Child Health and Human Development Maternal-Fetal Medicine Units Network

BACKGROUND: While there are well-accepted standards for the diagnosis of arrested active-phase labor, the definition of a "failed" induction of labor remains less certain. One approach to diagnosing a failed induction is based on the duration of the latent phase. However, a standard for the minimum duration that the latent phase of a labor induction should continue, absent acute maternal or fetal indications for cesarean delivery, remains lacking.

OBJECTIVE: The objective of this study was to determine the frequency of adverse maternal and perinatal outcomes as a function of the duration of the latent phase among nulliparous women undergoing labor induction.

STUDY DESIGN: This study is based on data from an obstetric cohort of women delivering at 25 US hospitals from 2008 through 2011. Nulliparous women who had a term singleton gestation in the cephalic presentation were eligible for this analysis if they underwent a labor induction. Consistent with prior studies, the latent phase was determined to begin once cervical ripening had ended, oxytocin was initiated, and rupture of membranes had occurred, and was determined to end once 5-cm dilation was achieved. The frequencies of cesarean delivery, as well as of adverse maternal (eg, postpartum hemorrhage, chorioamnionitis) and perinatal (eg, a composite frequency of seizures, sepsis, bone or nerve injury, encephalopathy, or death) outcomes, were compared as a function of the duration of the latent phase (analyzed with time both as a continuous measure and categorized in 3-hour increments).

RESULTS: A total of 10,677 women were available for analysis. In the vast majority (96.4%) of women, the active phase had been reached by 15 hours. The longer the duration of a woman's latent phase, the greater her chance of ultimately undergoing a cesarean delivery ($P < .001$, for time both as a continuous and categorical independent variable), although >40% of women whose latent phase lasted ≥18 hours still had a vaginal delivery. Several maternal morbidities, such as postpartum hemorrhage ($P < .001$) and chorioamnionitis ($P < .001$), increased in frequency as the length of latent phase increased. Conversely, the frequencies of most adverse perinatal outcomes were statistically stable over time.

CONCLUSION: The large majority of women undergoing labor induction will have entered the active phase by 15 hours after oxytocin has started and rupture of membranes has occurred. Maternal adverse outcomes become statistically more frequent with greater time in the latent phase, although the absolute increase in frequency is relatively small. These data suggest that cesarean delivery should not be undertaken during the latent phase prior to at least 15 hours after oxytocin and rupture of membranes have occurred. The decision to continue labor beyond this point should be individualized, and may take into account factors such as other evidence of labor progress.

Key words: labor induction, latent phase, outcomes

Introduction

Induction of labor has become an increasingly utilized obstetric intervention. Over the last 2 decades, its use has more than doubled, and at present, approximately 1 in 4 pregnant women have their labor induced.[1] One conundrum faced by clinicians who are caring for women undergoing labor induction is whether the benefits outweigh the risks of continuing labor when a woman remains in the latent phase for an extended period of time. When a cesarean delivery occurs in the latent phase of a labor induction, the indication is sometimes labeled as "failed." However, there has not been consensus regarding the criterion for this indication, and as a result, the approach to obstetric management in the latent phase for women undergoing labor induction varies among providers and institutions.[2]

EDITORS' CHOICE

Rouse et al[3] formulated one approach to defining a failed induction.[3] They defined the latent phase as beginning when both oxytocin had been initiated and rupture of membranes (ROM) had occurred, and ending at either 4-cm dilation and 90% effacement or 5-cm dilation regardless of effacement. Obstetric outcomes were then studied as a function of the length of the latent phase in induced labors. They concluded that the latent phase could be allowed to extend to at least 12 hours without excess obstetric morbidity. However, their study population was relatively small and from a single site, and they could not adequately assess durations of the latent phase >12 hours. Three other studies were performed that approached the diagnosis of a failed induction from this perspective, and to varying degrees had similar methodological limitations.[4-6]

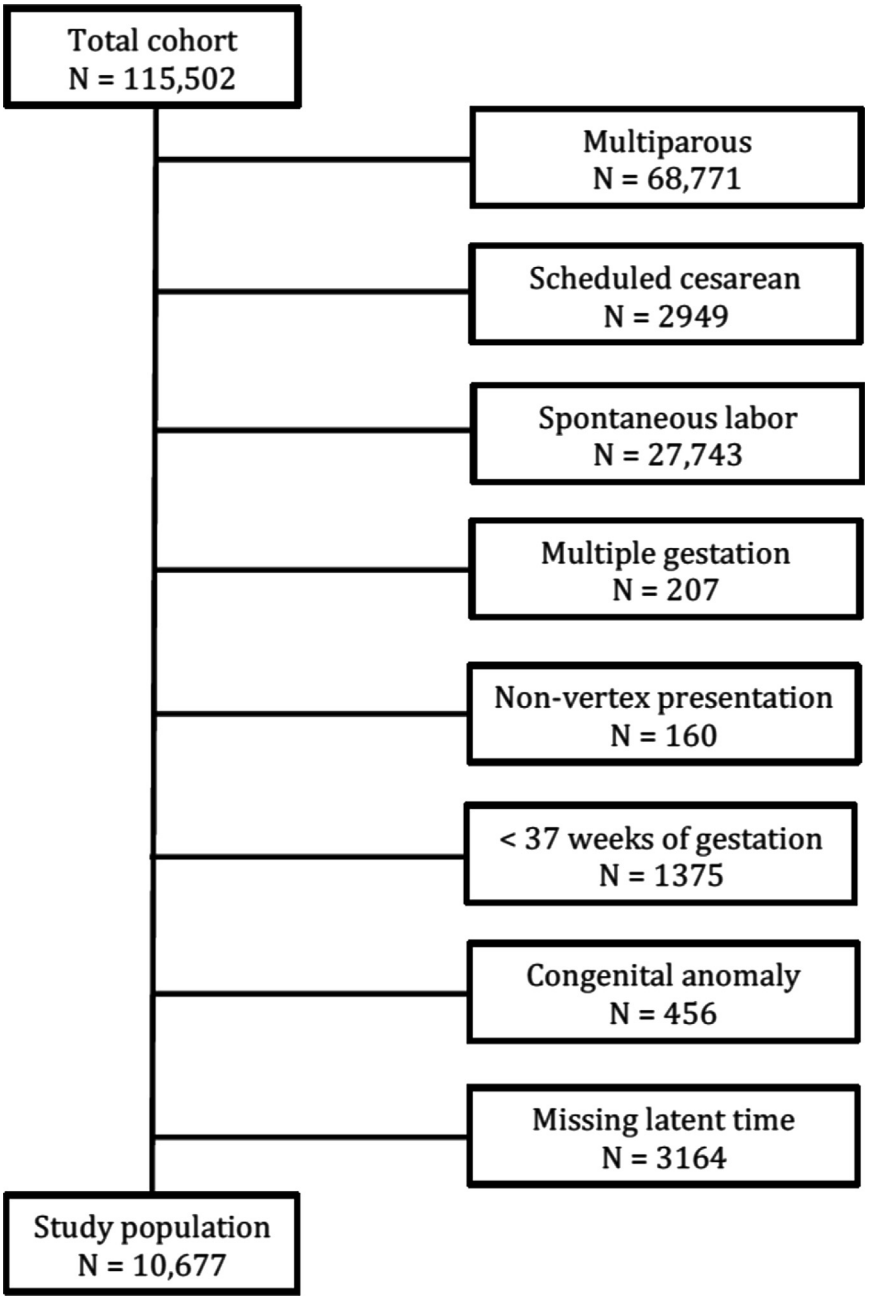
Determining a standard and evidence-based criterion for a cesarean that is performed in the latent phase for the sole reason that the patient has not entered the active phase is important if unnecessary cesarean deliveries are to be

Cite this article as: Grobman WA, Bailit J, Lai Y, et al. Defining failed induction of labor. Am J Obstet Gynecol 2018;218:122.e1-8.

0002-9378/free

https://doi.org/10.1016/j.ajog.2017.11.556

FIGURE
Flowchart illustrating composition of study population



Flowchart illustrating composition of study population of nulliparous women at term with non-anomalous vertex singleton gestations undergoing labor induction.

Grobman et al. Defining failed induction of labor. Am J Obstet Gynecol 2018.

minimized and interinstitutional comparisons of care are to be possible.[7] Thus, the purpose of this analysis was to determine, among a large and geographically varied population of nulliparous women undergoing labor induction, the maternal and neonatal outcomes associated with the length of the latent phase of labor.

Materials and Methods

From 2008 through 2011, investigators at the *Eunice Kennedy Shriver* National Institute of Child Health and Human Development Maternal-Fetal Medicine Units Network performed an observational study (ie, the APEX study). In this study, patient characteristics, intrapartum events, and pregnancy outcomes were collected on all women of at least 23 0/7 weeks with a live fetus on admission and delivered on randomly selected days representing one third of deliveries over a 3-year period at 25 participating hospitals. Trained and certified research personnel abstracted all charts. All centers obtained institutional review board approval and a waiver of informed consent. Full details of the technique of data collection were described previously.[8]

Women were considered eligible for this analysis if they were nulliparous; had a singleton, cephalic gestation at ≥37 weeks; and underwent labor induction. The duration of the latent phase was defined in a similar fashion to that first elaborated by Rouse et al[3] and subsequently used by others in their analyses of the latent phase during labor induction. Specifically, the latent phase of labor in the setting of induction was defined to begin once any cervical ripening had been completed (ie, when it was no longer used), oxytocin had begun, and ROM (either spontaneously or artificially) had occurred. Latent phase labor was defined to end once at least 5-cm dilation had been reached (or if cesarean occurred before that dilation). Women were excluded from the primary analysis if any of the times needed to calculate the length of the latent phase (eg, time at ROM, time at oxytocin initiation, time at least 5 cm was reached) were not available in the chart and, correspondingly, the length of the latent phase could not be determined.

Patient outcomes, including the frequency of cesarean delivery, adverse maternal outcomes (clinically diagnosed chorioamnionitis, postpartum hemorrhage, hysterectomy), and adverse neonatal outcomes were compared as a function of the duration of the latent phase. The primary adverse neonatal outcome was a composite that was defined to occur when a neonate had any of the following: seizures, culture-proven