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Obstetrician call schedule and obstetric outcomes among women eligible for a trial of labor after cesarean

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Abstract

BACKGROUND—Reducing cesarean deliveries is a major public health goal. The low rate of vaginal birth after cesarean (VBAC) has been attributed largely to a decrease in likelihood of choosing a trial of labor after cesarean (TOLAC), despite evidence suggesting a majority of women with one prior low transverse cesarean are TOLAC candidates. While a number of reasons for this decrease have been explored, it remains unclear how systems issues such as physician call schedules influence delivery approach and mode in this context.

OBJECTIVE—To investigate the relationship between obstetricians' call schedule and obstetric outcomes among women eligible for a TOLAC.

STUDY DESIGN—This is a retrospective cohort study of likelihood of attempting TOLAC and achieving VBAC among women with one prior low transverse cesarean delivery and a term, cephalic singleton gestation based on delivering provider's call schedule. Attending obstetrician call schedules were classified as traditional or "night float" call. Night float call was defined as a schedule in which the provider only had clinical responsibilities for a day or night shift, without other clinical responsibilities before or after the period of responsibility for laboring patients. Call schedules are determined by individual provider groups. Bivariable analyses and random effects logistic regression were used to examine the relationship between obstetricians' call schedule and the frequency of TOLAC. Secondary outcomes including frequency of VBAC and maternal and neonatal outcomes also were assessed.

RESULTS—Of 1502 eligible patients, 556 (37%) were delivered by physicians in a night float call system. 22.6% underwent TOLAC and 12.8% achieved VBAC; the VBAC rate for women attempting TOLAC was 56.5%. Women were more likely to undergo TOLAC (33.1% vs. 16.5%, $p<0.001$) and achieve VBAC (18.7% vs. 9.3%, $p<0.001$) when cared for by physicians with a night float call schedule. Regression analysis demonstrated physicians with a night float call schedule

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remained significantly more likely to have patients undergo TOLAC (aOR 2.64, 95% CI 1.65-4.25) and experience VBAC (aOR 2.17, 95% CI 1.36-3.45) after adjusting for potential confounders. However, the likelihood of achieving VBAC if TOLAC was attempted was not different based on provider call type (aOR 0.96, 95% CI 0.57-1.62). Although women delivered by providers with a night float schedule were more likely to experience uterine rupture (1.8% vs. 0.6%, $p=0.03$), chorioamnionitis (4.3% vs. 1.7%, $p=0.002$), postpartum hemorrhage (7.6% vs. 4.8%, $p=0.03$), and neonates admitted to the NICU (6.8% vs 3.9%, $p=0.01$), these associations did not persist when the population was limited to women attempting TOLAC.

CONCLUSIONS—While physicians working on a night float call system were significantly more likely to have patients with a prior cesarean undergo TOLAC and achieve VBAC, their patients also were more likely to experience maternal and neonatal morbidity. However, these differences did not persist when limiting analyses to women attempting TOLAC. Employing a night float call schedule may be an effective measure to promote TOLAC and VBAC.

Keywords

trial of labor after cesarean; vaginal birth after cesarean; call schedule; physician schedule; night float

INTRODUCTION

The rising cesarean rate in the United States is a substantial public health and clinical concern. Approximately 90% of low-risk women with a prior cesarean undergo repeat cesarean delivery, and data from 2003-2009 suggest the increase in repeat cesarean deliveries has contributed to half of the increase in the cesarean rate.^{1,2} Reducing both primary and repeat cesarean deliveries is a goal of numerous professional organizations and the U.S. Department of Health and Human Services.^{1,3} With regard to repeat cesarean deliveries, the decrease in the vaginal birth after cesarean (VBAC) rate has been attributed largely to a decrease in the likelihood of choosing a trial of labor after cesarean (TOLAC),⁴ despite evidence suggesting a majority of women with one prior low transverse cesarean are TOLAC candidates.⁵ Although many factors contribute to delivery decisions in the setting of a prior cesarean, little work has addressed how systems issues such as physician call schedules influence delivery approach and mode.

The American College of Obstetricians and Gynecologists notes that after appropriate counseling, “the ultimate decision to undergo TOLAC or a repeat cesarean delivery should be made by the patient in consultation with her health care provider.”⁵ Yet, a growing body of evidence suggests providers influence patient decisions via directive counseling as well as other more indirect provider attributes.⁶⁻⁸ One potential provider factor that may influence delivery approach is the type of call schedule, or the manner in which a physician's group handles nighttime hospital responsibilities. Prior work by Barber et al found that the transition from a traditional call schedule to a night float system was associated with changes in practice patterns at the time of delivery.⁹ Specifically, patients were less likely to undergo induction of labor or receive an episiotomy when cared for by a physician working in a night float system; in addition, major perineal lacerations and umbilical artery pH <7.10

were less frequent with a night float system.⁹ These data suggest physician factors such as call schedule may be associated with intrapartum decision making and care.

However, these relationships have not been studied for women who have one prior cesarean delivery and are eligible for trial of labor after cesarean. Understanding these relationships may identify an additional important avenue by which the rising cesarean delivery rate may be addressed from a systems perspective. It is plausible that physicians who practice in a night float system – where nighttime providers caring for laboring patients are not responsible for post-call clinical activities, and daytime providers are not responsible for clinical care at night after a full clinical day – may be more likely to offer TOLAC to eligible patients due to less concern for achieving daytime deliveries to ease nighttime or post-call clinical responsibilities. This greater likelihood of offering TOLAC may then be associated with an increased rate of VBAC. Thus, we designed this study to assess the association between physician type of call schedule and likelihood of TOLAC and VBAC in a population of women eligible for TOLAC.

MATERIALS AND METHODS

This is a retrospective cohort study of women delivering at a single institution who were eligible to undergo a TOLAC. Patients eligible for study inclusion were primiparas age 18 or over with one prior low transverse cesarean delivery (CD) and a term, cephalic singleton gestation. All deliveries meeting criteria from 1/2008 to 6/2013 were reviewed in order to provide a final population for analysis that would allow for adequate power. The population was limited to women with one prior CD and no prior vaginal delivery in order to restrict the cohort to low-risk TOLAC candidates whose delivery approach counseling would not have been influenced by prior vaginal birth(s) or multiple prior cesarean deliveries. Women with fetuses with major anomalies, who had a fetal demise, or who were otherwise ineligible for vaginal birth (placenta previa, prior classical CD, prior cavity-entering myomectomy) were excluded. Women were not excluded for medical comorbidities unless those comorbidities were contraindications to labor. Data were abstracted from the electronic medical record. Institutional Review Board approval from Northwestern University was obtained prior to initiation of the study.

Attending physicians caring for each patient were categorized as either “traditional call” (N=58) or “night float” (N=36) call; these 94 obstetricians comprised 82% of the obstetricians delivering at this institution over the study period.⁸ Night float providers were those who practiced in a group where the on-call night obstetrician provided hospital care for several nights sequentially without daytime office or other clinical responsibilities. Groups had different numbers of sequential nights in a night float system, but all providers categorized as night float were those whose only clinical responsibility was for hospitalized patients in either a day or night shift; shifts were followed by time for sleep prior to a subsequent shift. All other provider call types were classified as traditional call, in which physicians performed daytime clinical responsibilities followed by nighttime call (either home or in the hospital), with possible subsequent partial or full-day clinical responsibilities the next day. All providers in this study practiced in a group setting, with all physicians in a group adhering to the same type of call schedule. Call schedule types were at the discretion

of each group. All deliveries at this institution are managed and attended by a member of the patient's provider group, with an in-house obstetrician available for emergency back-up. Resident physicians are involved in the care of all patients with a prior CD, and resident physicians function on a night float call system; thus, analysis was assessed on the basis of the call schedule of the delivering attending physician's group. All final decisions about undergoing TOLAC or intrapartum care are made by attending physicians.

Sample size was determined based on the number of patients needed to demonstrate a difference in TOLAC rate between patients delivered by providers with night float versus traditional call. Prior work has suggested an institutional TOLAC rate of approximately 22%, and work by Barber et al suggested a 40% relative difference in induction of labor rates based on call type.⁹ Assuming a 1:2 patient ratio for night float to traditional call based on knowledge of practice patterns at this institution, 1053 patients are required for 90% power, with $\alpha = 0.05$, to detect a similar relative difference in TOLAC rate.

The primary outcome was frequency of TOLAC. Secondary outcomes included frequency of VBAC (i.e., both overall VBAC rate and VBAC rate if TOLAC attempted) and maternal and neonatal adverse outcomes. Maternal secondary outcomes included uterine rupture (defined as uterine rupture with clinical consequence for the mother or fetus, and not including an incidentally-noted uterine "window" or scar dehiscence), maternal chorioamnionitis (defined as a temperature $> 100.3^{\circ}$ F without an identified etiology other than intrauterine infection), postpartum hemorrhage (defined as estimated blood loss > 500 cc for a vaginal delivery or > 1000 cc for a CD), major perineal lacerations (defined as a 3rd or 4th degree laceration), episiotomy, and maternal ICU admission. Neonatal outcomes included 5-minute Apgar score ≤ 4 , umbilical cord artery pH < 7.0 , sepsis, seizures, hypoxic ischemic encephalopathy, and admission to the neonatal intensive care unit (NICU).

We compared patient characteristics stratified by their physician's call type using chi-squared and ANOVA tests. Bivariable analyses of the primary and secondary outcomes were then assessed using chi-square tests. Random effects multivariable logistic regression models were utilized to examine relationships between physician call schedule and the odds of primary and secondary outcomes. The regression analysis adjusted for potential confounders, including patient characteristics identified to be significantly associated in univariable analysis ($p < 0.1$) with provider call type, and delivering physicians; the latter were entered into the regression as random effects terms in order to account for the effect of non-independence due to clustering by physician and to account for differences in physicians. Secondary outcomes were not adjusted for mode of delivery as delivery route is on the causal pathway for many outcomes; however, where relevant, the population was limited to those choosing TOLAC, since certain outcomes are not possible if TOLAC is not undertaken (episiotomy, major perineal laceration, and shoulder dystocia). A further analysis was performed in which odds of VBAC and odds of adverse maternal and neonatal outcomes were analyzed in a sample restricted to those undergoing TOLAC. Statistical analyses were undertaken using Stata v13 (College Station, TX). All analyses were two-tailed and $p < .05$ was used to define statistical significance.

RESULTS

In this cohort, 1502 women met criteria for inclusion. Of these, 556 (37%) were delivered by physicians who use a night float call system. The majority of patients were privately insured, non-Hispanic white race/ethnicity, and over age 30 (Table 1). Patients did not differ on most characteristics based on their physicians' call schedule, including with respect to maternal age, race/ethnicity, insurance status, or neonatal birth weight. Women delivered by night float physicians had a statistically, though not clinically meaningfully, later mean gestational age at delivery (39.2 vs 39.1 weeks, $p<0.001$) than women delivered by physicians with a night float system. Patients delivered by night float call physicians were more likely to deliver between 7pm and 7am (40.0 vs 15.8%, $p<0.001$).

In the study population, 340 women (22.6%) underwent TOLAC. In total, 1310 women (87.2%) experienced cesarean delivery, and 192 (12.8%) experienced VBAC. Of those attempting TOLAC, the VBAC rate was 56.5%. Differences in delivery approach and mode based on provider call type are demonstrated in Table 2. Women who were delivered by a night float physician were more likely to undergo TOLAC than women who were delivered by a traditional call physician (33.1% vs 16.5%, $p<0.001$). The odds of experiencing TOLAC was nearly three-fold higher for women delivered by a night float physician, when accounting for patient body mass index, gestational age, and clustering by physician (adjusted odds ratio [aOR] 2.64, 95% confidence interval [CI] 1.65-4.25). The overall VBAC rate also was greater for women delivered by night float physicians (18.7% vs 9.3%, $p<0.001$); this difference remained statistically significant on multivariable logistic regression (aOR 2.17, 95% CI 1.36-3.45). However, the likelihood of achieving VBAC if TOLAC was attempted was not different based on provider call type (56.5% vs 56.4%, $p=0.98$; aOR 0.96, 95% CI 0.57-1.62).

Maternal and neonatal secondary outcomes were examined (Table 3). We identified no differences in rates of induction of labor, operative vaginal delivery (if VBAC), episiotomy use (if TOLAC attempted), or major perineal laceration (if TOLAC attempted) based on provider call type. Women who were delivered by physicians with a night float call schedule were more likely to experience uterine rupture (aOR 2.92, 95% CI 1.05-8.11), chorioamnionitis (aOR 2.36, 95% CI 1.24-4.54) and postpartum hemorrhage (aOR 1.75, 95% CI 1.06-2.89). With regard to neonatal outcomes, we identified no differences in shoulder dystocia (if TOLAC attempted), 5-minute Apgar score 4, or cord umbilical artery pH <7.0 . Neonates born to women who were delivered by physicians with a night float schedule were more likely to be admitted to the neonatal intensive care unit (aOR 1.92, 95% CI 1.14-3.22). There were no cases of neonatal sepsis or death, and only one case of neonatal hypoxic ischemic encephalopathy, and thus differences in these rare events are unable to be assessed. Notably, when restricting the analysis of secondary outcomes solely to the population undergoing TOLAC, there were no differences in risk of maternal or neonatal secondary outcomes based on provider call type. Specifically, there was no increased odds of uterine rupture (aOR 1.40, 95% CI 0.45-4.38), chorioamnionitis (aOR 1.08, 95% CI 0.53-2.17), postpartum hemorrhage (aOR 1.54, 95% CI 0.57-4.12), or NICU admission (aOR 1.90, 95% CI 0.92-3.96) with a night float call schedule.

COMMENT

Reducing the rising rate of cesarean deliveries in the United States is a clinical and public health priority.^{1,3} Our work demonstrates an association between the obstetrician's call schedule type and their patients' likelihood of undergoing TOLAC. These data identified a greater than two-fold increase in likelihood of attempting TOLAC, with a correspondent similar magnitude increase in achieving VBAC, when a physician practiced in a group utilizing a "night float" call system. This type of call system thus was associated with the increased likelihood of vaginal delivery, but at the "cost" of increased chance of delivery occurring at night. However, in the subgroup of women undergoing TOLAC, odds of VBAC did not differ by their physician's call system, suggesting the crux of this issue lies in the decision to undertake TOLAC rather than in management of labor once TOLAC has been chosen. Under the night float system, in which physicians are responsible for only day or night shifts without concern for exhaustion and/or post-call clinical responsibilities, it is plausible that clinicians may more readily provide counseling and clinical care in which the clinical needs of the patient, rather than the scheduling needs of the provider, are prioritized. In a night float system, for example, providers may worry less about signing out to their on-call colleague the management of a patient undergoing a TOLAC when the expectation is of a ready and willing nighttime provider whose sole responsibility is the care of hospitalized patients. As the majority of women decide whether to undergo TOLAC while in an outpatient setting, this shift in the labor and delivery culture may primarily manifest in the outpatient counseling for patients considering TOLAC. Alternatively, it is possible that the relationships observed are patient-driven; for example, patients more likely to desire TOLAC may also be more likely to choose a night float provider group.

Although the likelihood of VBAC did not differ by call type once TOLAC was undertaken, patients delivered by physicians on a night float system appeared to experience overall increased odds of morbidity. These differences do not appear to be attributable to the type of women who received care under each call system, as the demographic characteristics of the groups were similar. Rather, these differences are likely attributable to undertaking TOLAC, as demonstrated by the analysis demonstrating the odds of adverse outcomes were not increased with night float when limiting the cohort to those undertaking TOLAC. Chorioamnionitis and uterine rupture, for example, are potential sequelae of labor, and undertaking a trial of labor inherently poses risks that are different from those experienced by patients undergoing elective cesarean delivery.⁵ Yet, neither approach is without risk, and adverse outcomes for primiparous women choosing repeat CD may not be realized in the index pregnancy, and instead may only emerge with subsequent gestations.⁵ It is also notable that the odds of NICU admission were increased in the night float group; while reasons for NICU admission were unavailable, this, too, may be related to labor, as the association did not persist when limiting the analysis to women attempting TOLAC. Importantly, major neonatal adverse outcomes, including hypoxic ischemic encephalopathy, academic cord gases, or neonatal sepsis, which are likely more meaningful differences than NICU admission, were extremely rare. In sum, while this study was not designed to assess the risks versus benefits of TOLAC versus repeat cesarean delivery, which have been extensively reported elsewhere, the data suggest that if a goal is to increase the TOLAC rate, a night

float call schedule may be one way to achieve this. However, further investigation is required to understand if there is a causal relationship between call schedule and TOLAC frequency.

Our results are supported by existing data demonstrating relationships between physician practice models and delivery outcomes. For example, in a Canadian hospital-based cohort in which physicians take traditional call, being delivered by the “on call” physician rather than the patient's primary physician was associated with greater odds of cesarean delivery and major perineal laceration.¹⁰ Older single institution reports identified that institution of a requirement for attending in-house coverage of deliveries resulted in significant decreases in the primary and repeat cesarean delivery rates.^{11,12} More recently, work at a California community hospital demonstrated lower primary and repeat cesarean deliveries when women were cared for within a midwife-obstetrician laborist (shift-based) practice model compared to a traditional private practice model.^{13,14} Along with our data, the results of these studies suggest obstetrical care provision may differ based on issues such as work schedule.

A significant strength of this work is the large volume of women delivering with a diverse group of obstetricians. In addition, we compared groups delivering contemporaneously, thus eliminating the possibility of unrelated secular trends accounting for differences in findings. There were no institutional protocol changes or other developments which may have selectively influenced results during this time period. In addition, the use of a random effects regression allowed us to account for clustering of patients by physician and for differences in physician characteristics that might have confounded the observed association. However, a number of limitations warrant consideration. The population was largely white and well-insured, suggesting findings may not be generalizable to more diverse populations, particularly to women from low socioeconomic backgrounds with poor access to healthcare. Further, as a cross-sectional study comparing different practice groups, it is possible that the observed differences by call schedule type may be attributable to other differences in the practice patterns of groups who choose to use a night float versus traditional call schedule. While the regression model accounting for clustering by physician accounts for differences in provider characteristics, such as age-related differences in providers or other differences such as board certification, we are unable to determine if there are other specific features of a group that affect their underlying decision to work in a particular call structure. Further, this institution is a teaching hospital in which trainees are involved in the care of all patients with a prior cesarean delivery; while attending physicians are responsible for all final decision-making for each individual patient, residents and a back-up emergency obstetrician are always on the labor floor and available to manage emergencies. Moreover, residents are equally involved in patients during the day versus at night and for all practice groups. While this feature of the institution may make the findings less generalizable to community settings, it should be also noted that the presence of residents and a back-up attending would likely only bias the findings toward the null. In addition, major adverse neonatal outcomes were uncommon, and thus we are underpowered to detect differences in these rare events. Finally, this was an observational study, and it is not possible to determine whether differences in the call schedule were causally related to the findings described. Future study of the outpatient counseling experience for patients eligible for TOLAC, particularly of

whether the frequency of offering TOLAC in the outpatient setting differs by call schedule, may provide information about if there is a causal relationship underlying these findings.

In summary, we identified that in a single, large teaching hospital, women who were eligible for TOLAC were more likely to undergo TOLAC if delivered by physicians in a night float call system, compared to a traditional call system, and the increased odds of experiencing TOLAC translated to increased odds of VBAC. A growing body of evidence suggests obstetrical outcomes, including route of delivery, are influenced by physician practice patterns and behaviors. While additional investigation is required to understand the mechanism behind the observed relationships, it is possible that employing a night float call schedule may be an effective measure to promote TOLAC and VBAC, as recommended by the American College of Obstetricians and Gynecologists and other organizations.⁵

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Table 1

Patient characteristics stratified by provider call schedule

	Traditional call (N=946)	Night float (N=556)	p-value
Age (years)	33.8 ± 4.5	34.1 ± 4.7	0.35
Body mass index (kg/m ²)	30.8 ± 6.0	30.3 ± 5.3	0.09
Ethnicity			0.47
Caucasian	648 (68.5%)	396 (71.2%)	
African American	95 (10.0%)	55 (9.9%)	
Hispanic	132 (14.0%)	62 (11.2%)	
Asian	71 (7.5%)	43 (7.7%)	
Insurance			0.97
Private	875 (92.5%)	514 (92.5%)	
Medicaid	71 (7.5%)	42 (7.6%)	
Gestational age (weeks)	39.1 ± 0.7	39.2 ± 0.8	<0.001
Birth weight (g)	3518 ± 458	3547 ± 472	0.23
Delivery between 7pm – 7am	184 (15.8%)	136 (40.0%)	<0.001

All data presented as mean ± standard deviation or N (%)

Table 2

Trial of labor and vaginal birth after cesarean stratified by physician call schedule

	Univariable analysis				Multivariable analysis *
	Traditional call (N=946)	Night float (N=556)	p-value	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
TOLAC	156 (16.5%)	184 (33.1%)	<0.001	2.50 (1.96 – 3.20)	2.64 (1.65-4.25)
VBAC	88 (9.3%)	104 (18.7%)	<0.001	2.24 (1.65-3.05)	2.17 (1.36-3.45)
VBAC if TOLAC attempted	88 (56.4%)	104 (56.5%)	0.98	1.00 (0.65 -1.55)	0.96 (0.57-1.62)

OR = odds ratio; VBAC = vaginal birth after cesarean delivery; TOLAC = trial of labor after cesarean delivery

* Adjusted for BMI, gestational age, and physician as a random effect

Table 3

Secondary maternal and neonatal outcomes stratified by physician call schedule

	Univariable analysis				Multivariable analysis *
	Traditional call (N=946)	Night float (N=556)	p-value	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Induction of labor	18 (1.9%)	19 (3.4%)	0.07	1.82 (0.95-3.51)	1.62 (0.72-3.65)
Operative vaginal delivery, if VD	16 (18.2%)	25 (24.0%)	0.32	1.42 (0.70-2.88)	1.48 (0.63-3.49)
Episiotomy, if TOLAC attempted	8 (9.1%)	3 (2.9%)	0.07	0.30 (0.08-1.16)	0.28 (0.07-1.12)
Major perineal laceration, if TOLAC attempted	4 (4.6%)	11 (10.6%)	0.12	2.48 (0.76-8.10)	2.51 (0.60-10.45)
Clinical evidence of uterine rupture	6 (0.6%)	10 (1.8%)	0.03	2.87 (1.04 – 7.94)	2.92 (1.05-8.11)
Chorioamnionitis	16 (1.7%)	24 (4.3%)	0.002	2.62 (1.38 – 4.98)	2.36 (1.24 – 4.54)
Postpartum hemorrhage	45 (4.8%)	42 (7.6%)	0.03	1.64 (1.06 – 2.53)	1.75 (1.06 – 2.89)
Shoulder dystocia, if TOLAC attempted	2 (1.3%)	6 (3.3%)	0.23	6.02 (1.25-29.07)	2.49 (0.49-12.60)
5-minute Apgar <4	2 (0.2%)	1(0.2%)	1.0	0.85 (0.08-9.40)	0.82 (0.07-9.19)
NICU admission	37 (3.9%)	38 (6.8%)	0.01	1.80 (1.13 – 2.87)	1.92 (1.14-3.22)
Cord umbilical artery pH <7.0	12 (1.3%)	13 (2.3%)	0.12	1.86 (0.84-4.11)	2.05 (0.92-4.57)

OR = odds ratio; VD = vaginal delivery; TOLAC = trial of labor after cesarean delivery; NICU = neonatal intensive care unit

* Adjusted for BMI, gestational age, and physician as a random effect