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Risk Factors for Classical Hysterotomy in Twin Pregnancies

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Abstract

OBJECTIVE—To describe the rate of classical hysterotomy in twin pregnancies across gestational age and examine risk factors that increase its occurrence.

METHODS—This is a secondary analysis of the Cesarean Registry, a cohort study of women who underwent a cesarean delivery or a trial of labor after cesarean delivery at 19 academic centers between 1999 and 2002. Our study included all women with twin pregnancies and a recorded hysterotomy type who underwent cesarean delivery between 23 0/7 and 41 6/7 weeks of gestation. Primary exposures were gestational age at delivery and combined birth weight of twin A and twin B. Multivariate logistic regression was used to study factors thought to influence hysterotomy type including maternal age, body mass index (BMI) at delivery, obesity (BMI 30 or higher), nulliparity, labor, prior cesarean delivery, emergent delivery, and fetal presentation at delivery.

RESULTS—Of 1,820 women meeting inclusion criteria, 125 (7%) underwent a classical hysterotomy. The risk of classical hysterotomy was greatest at 25 weeks of gestation (41%) and declined thereafter. The adjusted odds ratio (OR) for cesarean delivery declined as gestation age advanced (OR 0.87, 95% confidence interval 0.78–0.98). African American race and emergent delivery were associated risk factors for classical hysterotomy at 32 weeks of gestation or greater.

CONCLUSION—Among women with twin pregnancies who deliver by cesarean, the incidence of classical hysterotomy is inversely related to gestational age but does not exceed 50% at any week; African American race and emergent delivery are associated risk factors at 32 weeks of gestation or greater.

LEVEL OF EVIDENCE—II

Classical hysterotomy has important implications for a woman's current pregnancy and for future childbearing. Compared with other hysterotomy types, women undergoing classical hysterotomy experience higher rates of blood transfusion, pain, infection, and, subsequently,

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uterine rupture,^{1–5} prompting recommendations for early delivery in future pregnancies (before labor onset).^{6,7} Gestational age is the greatest risk factor for classical hysterotomy in singleton pregnancies,⁸ likely as a result of underdevelopment of the lower uterine segment. Additional factors may increase the risk of classical hysterotomy including nonvertex presentation, uterine leiomyomas, dense bladder adhesions, and extremes of birth weight.^{4,9}

Previously, we described risk factors for classical hysterotomy in singleton pregnancies such as low birth weight and noncephalic presentation.⁸ Rates of both preterm and cesarean delivery are higher in twin pregnancies, theoretically predisposing them to a higher risk of classical hysterotomy.¹⁰ Complicating this risk is the effect of intrauterine mass, because twin pregnancies may have twice the intrauterine mass as singleton pregnancies for the same gestational age. The actual risk for classical hysterotomy in twin pregnancies is unknown, yet this risk is important for patient counseling and decision-making.

The objectives of this study are to describe the incidence of classical hysterotomy by gestational age in twin pregnancies and associated risk factors. In addition, we sought to examine the relationship between gestational age, intrauterine mass, and classical hysterotomy by comparing twin and singleton pregnancies.

MATERIALS AND METHODS

This is a secondary analysis of the Cesarean Registry, an observational cohort study conducted by the *Eunice Kennedy Shriver* National Institute of Child Health and Human Development Maternal-Fetal Medicine Units Network between 1999 and 2002. The original study included all women who delivered at 20 weeks of gestation or greater and either underwent a cesarean delivery or a trial of labor after cesarean delivery. Data were obtained from labor and delivery records and review of maternal and neonatal charts. Further details can be found elsewhere.^{6,11}

The present study includes all women with singleton or twin pregnancies who underwent a cesarean delivery with a known hysterotomy type between 23 0/7 and 41 6/7 weeks of gestation. Four hysterotomy categories were present in the original data set: low transverse, classical, low vertical, and “T or J.” “T” and “J” hysterotomies were reported together in one category. For the purpose of analysis, women with a low vertical hysterotomy (n=45) were included in the low transverse hysterotomy group and women with a “T or J” hysterotomy type (n=20) were included in the classical hysterotomy group based on the relatively small number of patients in these categories and whether labor is deemed acceptable in a subsequent pregnancy.

Gestational age at delivery and intrauterine mass were selected as the primary exposures of interest. Because two fetuses contribute to the intrauterine mass in twin pregnancies, the birth weights of twin A and twin B were added together to create a combined birth weight variable. The following covariates were selected a priori as additional risk factors or potential confounders for classical hysterotomy in twin pregnancies: maternal age, body mass index (calculated as weight (kg)/[height (m)]²) at delivery, obesity (body mass index 30 or higher), nulliparity, labor, prior cesarean delivery, emergent delivery, fetal

presentation at delivery, and abnormal placentation (placenta accreta and previa). Because so few women in the cohort had pregnancies complicated by abnormal placentation, this variable was not included in the final analysis. The risks of classical hysterotomy by gestational age and by birth weight category were then compared between twin and singleton pregnancies using data previously published from this cohort for singletons.⁸

Categorical variables were analyzed using χ^2 test or Fisher's exact test where appropriate and relative risk and 95% confidence intervals were reported. Continuous variables were analyzed using the Student's *t* test or the Mann-Whitney *U* test depending on their distributions. Multivariate logistic regression was performed to identify covariates associated with classical hysterotomy in twin pregnancies. A backward elimination model selection was used to identify risk factors for classical hysterotomy by retaining those that were significant at the $P < .10$ level. Additionally, interaction terms were added to the model, and those that interacted significantly with gestational age at the $P < .05$ level were examined in an analysis stratified by less than 32 compared with 32 weeks of gestation or greater. Thirty-two weeks of gestation was selected as a cut point because this was the median gestational age at which classical hysterotomy occurred in the current data set. Covariates that changed the odds ratio for gestational age by greater than 10% were considered confounders. All tests were two-tailed and a *P* value of $< .05$ was considered statistically significant. SAS 9.4 was used for the analyses. Because the database utilized for this study contained only deidentified data, the institutional review board at Stanford University exempted this study.

RESULTS

During the study period, 2,296 women with twin gestations delivered two live neonates by cesarean at 23 weeks of gestation or greater. Hysterotomy type was unknown in 476 women, leaving 1,820 women for the final analysis. The frequency of hysterotomy types was: 91% ($n=1,650$) low transverse, 6% ($n=105$) classical, 2% ($n=45$) low vertical, and 1% ($n=20$) "T or J." For the remainder of the analysis, low vertical hysterotomy was combined with low transverse hysterotomy ($n=1,695$) and "T or J" hysterotomy was combined with classical hysterotomy ($n=125$). In twin pregnancies, the risk of classical hysterotomy peaked at 25 weeks of gestation at 41% and declined steadily thereafter (P for trend $< .001$). Women with twin pregnancies requiring classical hysterotomy were younger, more likely to be African American, and multiparous. Furthermore, they were more likely to be in labor at the time of delivery and to undergo an emergent delivery (Table 1). There were no differences between groups with regard to history or number of prior cesarean deliveries.

The absolute frequency of classical hysterotomy by gestational age is shown in Figure 1. Every 1-week increase in gestational age resulted in a 20% decrease in the odds for classical hysterotomy (odds ratio [OR] 0.80, 95% confidence interval [CI] 0.77–0.84) (Table 2). The selected covariates did not confound this relationship significantly (adjusted OR 0.87, 95% CI 0.78–0.98). In addition, every 500-g increase in birth weight was associated with a 28% reduction in the odds for classical hysterotomy; however, after adjusting for gestational age, this relationship was no longer statistically significant (adjusted OR 0.88, 95% CI 0.74–

1.04). African American race and emergent delivery were risk factors for classical hysterotomy in twin pregnancies, but only at 32 weeks of gestation or greater.

Twin and singleton pregnancies were then examined together ($n=38,836$) using previously published data on classical hysterotomy in singleton pregnancies.⁸ The absolute frequency of classical hysterotomy in twin pregnancies undergoing cesarean delivery was less than that in singleton pregnancies across gestational ages until 37 weeks of gestation (Fig. 1) (relative risk 0.53, 95% CI 0.43–0.64). However, when comparing this frequency by combined birth weight, the frequency of classical hysterotomy was higher in twin pregnancies for every 500-g increase in combined birth weight (Fig. 2). This was statistically significant for each birth weight category. Similarly in multivariate regression, twin pregnancy was associated with a 40% decreased odds for classical hysterotomy after accounting for gestational age (OR 0.58, 95% CI 0.47–0.71) but a threefold increase in this odds after accounting for birth weight alone (OR 3.76, 95% CI 3.04–4.66). Adjusting for potential confounders (nulliparity, African American race, noncephalic presentation, emergent delivery) did not alter these findings significantly. In a fully adjusted model with birth weight, gestational age and potential confounders included, the effect of being a twin pregnancy was null (OR 0.93, 95% CI 0.71–1.22).

DISCUSSION

The risk of classical hysterotomy is an important consideration for women with twin pregnancies given high rates of both preterm and cesarean delivery.¹⁰ Patient counseling regarding these risks is particularly important at extremely preterm gestational ages (less than 28 weeks) when the risk for classical hysterotomy is greater and therefore may have more negative consequences on future childbearing. As outcomes improve for extremely preterm and extremely low-birth-weight neonates (less than 1,000 g), interventions such as cesarean delivery are considered at earlier gestational ages.¹²

Our study has several important findings. First, although the risk of classical hysterotomy in twin pregnancies is inversely related to gestational age, it does not exceed 50% at any week (95% CI 27.2–62.1%) at any week of gestation, is highest at 25 weeks of gestation, and is less than 10% (95% CI 1.4–7.1) by 32 weeks of gestation. At later gestational ages (32 weeks or greater), only African American race and emergent delivery were associated with an increase in the odds for classical hysterotomy. We speculate that health care practitioners were more likely to perform a classical hysterotomy without examination of the lower uterine segment in cases of emergent delivery.

We hypothesized that the risk of classical hysterotomy would be altered by factors that could modify the lower uterine segment. However, at early gestational ages (less than 32 weeks), no significant risk factors for classical hysterotomy were observed (other than gestational age itself). One explanation for this is that, at early gestational ages, maturation of the lower uterine segment is so dominated by gestational age that other factors are relatively insignificant. If development of the lower uterine segment were purely a function of intrauterine mass, twin and singleton pregnancies should have approximately equal risks of classical hysterotomy for the same combined birth weight. In fact, twin pregnancies

experience a higher rate of classical hysterotomy for every 500-g increase in combined birth weight, even after adjusting for additional confounders such as noncephalic presentation, emergent delivery, and parity. After accounting for gestational age at delivery, twin pregnancy was no longer associated with classical hysterotomy. This is not to discount the important influence of birth weight on classical hysterotomy risk, but rather to suggest that there must be a gestational age-dependent maturation of the lower uterine segment that occurs independent of intrauterine mass.

This study has several important limitations. As a retrospective study, we are limited by data collected in the original cohort such as the presence of uterine leiomyomas, history of prior abdominal surgeries, or sterilization at the time of cesarean delivery, factors that may limit safe access to the lower uterine segment or, in the last instance, lower the threshold to perform a classical hysterotomy. Importantly, there is no information regarding physician choice for hysterotomy. It may be the practice that some health care providers select a classical hysterotomy based entirely on gestational age. In addition, we lack information regarding difficulties delivering one or both twins such as in the case with interlocking twins or a second twin that is in transverse backup presentation. Finally, although this study includes a large, detailed cohort of cesarean deliveries in twin pregnancies, only 125 women with twin pregnancies underwent a classical hysterotomy. It is possible that additional risk factors for classical hysterotomy are present that we lack statistical power to detect.

Our study adds to the limited literature on classical hysterotomy in twin pregnancies. Although multiple studies document higher rates of perinatal morbidity associated with classical hysterotomy, far fewer explore risk factors for classical hysterotomy, and almost all have excluded twin pregnancies.^{1,3,9} In addition, our study attempts to address the anatomic and physiologic changes of the lower uterine segment that may occur throughout pregnancy, which would be difficult, if not impossible, to study in vivo. One study indirectly addressed this question by studying hysterotomy selection in very-low-birth-weight neonates weighing between 500 and 1,500 g.¹³ The authors found no association between birth weight and hysterotomy type but they did note a statistically significant increase in the incidence of vertical incisions (classical and low vertical hysterotomies) for neonates born less than 28 weeks of gestation. Although this study was limited by a small sample size of 89 women with only 15 vertical hysterotomies, our findings are consistent.

In summary, among women with twin pregnancies who deliver by cesarean, the incidence of classical hysterotomy is inversely related to gestational age but does not exceed 50% at any week, and no additional risk factors could be identified at very preterm gestational ages (less than 32 weeks).

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Fig. 1.

Frequency of classical hysterotomy in twin and singleton pregnancies by gestational age in weeks. Standard deviation is represented by the error bars. Numbers above each box represent the sample size.

Fig. 2.

Frequency of classical hysterotomy in twin and singleton pregnancies by birth weight in grams (combined birth weight for twin pregnancies). Standard deviation is represented by the error bars. Numbers above each box represent the sample size.

Table 1

Demographic and Obstetric Characteristics by Hysterotomy Type

Characteristic	Classical* (n=125)	Low Transverse† (n=1,695)	P
Maternal age (y)	26.9±5.7	28.2±6.1	.02
African American race	57 (45.6)	493 (29.1)	<.001
Nulliparity	38 (30.4)	663/1,687 (39.3)	.05
Public insurance	50/114 (43.9)	581/1,610 (36.1)	.10
Gestational age at delivery (wk)	31.1±4.8	34.8±3.4	<.001
Previous cesarean delivery	25 (20.0)	380/1,680 (22.6)	.50
Emergent delivery	51 (40.8)	262 (15.5)	<.001
Labor	86/124 (69.4)	909 (53.7)	<.001
BMI (kg/m ²) at delivery	31.6±7.0	33.0±7.1	.04
BMI 30.0 or greater	55 (44.0)	703/1,625 (58.5)	.002
Combined twin birth weight (g)	3,142±1,648	4,416±1,322	<.001
Twin A noncephalic presentation	51/124 (41.1)	764/1,691 (45.2)	.38
Presentation			.07
Twin A cephalic, twin B cephalic	22/122 (18.0)	404/1,688 (22.3)	
Twin A cephalic, twin B noncephalic	50/122 (41.0)	520/1,688 (30.8)	
Twin A noncephalic, twin B cephalic	13/122 (10.7)	258/1,688 (15.3)	
Twin A noncephalic, twin B noncephalic	37/122 (30.3)	506/1,688 (30.0)	
Neonatal death	20/122 (18.0)	41/1,688 (2.5)	<.001

BMI, body mass index.

Data are mean±standard deviation, n (%), or n/N (%) unless otherwise specified.

* Includes "T" or "J" hysterotomy.

† Includes low vertical hysterotomy.

Table 2

Multivariable Logistic Regression for Classical Hysterotomy in Twin Pregnancies

Variable	P for Interaction *	Crude OR (95% CI)	Adjusted OR (95% CI)	
			Less Than 32 wk of Gestation (n=1,820)	32 wk of Gestation or Greater (n=1,440) ‡
Gestational age	NA	0.80 (0.77–0.84)	0.87 (0.78–0.98)	
Nulliparity	.13	0.68 (0.46–1.00)	0.67 (0.42–1.06)	
Fetal presentation	.05			
A cephalic, B cephalic		Reference	Reference	
A cephalic, B noncephalic		1.76 (1.05–2.96)	1.44 (0.84–2.49)	
A noncephalic, B cephalic		0.92 (0.46–1.87)	0.95 (0.45–2.00)	
A noncephalic, B noncephalic		1.34 (0.78–2.31)	1.22 (0.69–2.16)	
African American race	.02	2.04 (1.42–2.95)	1.26 (0.69–2.30)	2.24 (1.26–4.00)
Emergent cesarean delivery	.09	3.77 (2.58–5.51)	1.47 (0.83–2.60)	3.39 (1.82–6.32)
Combined birth weight	<.001	0.72 (0.68–0.78)	0.69 (0.47–1.02)	0.97 (0.78–1.19)
Previous cesarean delivery	.03	0.86 (0.54–1.34)	0.50 (0.21–1.17)	1.24 (0.63–2.46)

OR, odds ratio; CI, confidence interval.

Bold indicates significant odds ratios.

* Interaction with gestational week at delivery.

‡ Adjusted for African American race, previous cesarean delivery, emergent delivery, presentation, nulliparity, gestational week at delivery, and combined birth weight.