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ORIGINAL ARTICLE

Emergent primary cesarean delivery and maternal operative morbidity

Eric P. Bergh[a], Luciana A. Vieira[a], Catherine A. Bigelow[a], Jessica R. Overbey[b] and Nathan S. Fox[a,c]

[a]Department of Obstetrics, Gynecology and Reproductive Science, Icahn School of Medicine at Mount Sinai, New York, NY, USA; [b]Center for Biostatistics, Icahn School of Medicine at Mount Sinai, New York, NY, USA; [c]Maternal Fetal Medicine Associates, PLLC, New York, NY, USA

ABSTRACT

Background: It is unknown how variations in surgical entry time in primary cesarean delivery (CD) may affect operative outcomes and maternal morbidity.

Objective: Determine whether performing a primary CD in labor emergently ("stat") is associated with adverse maternal outcomes.

Study design: Retrospective cohort study of patients who underwent primary CD at The Mount Sinai Hospital during the years of 2011–2016. Women with a singleton pregnancy and without a prior uterine scar attempting a trial of labor were included. An emergent CD was defined as a skin-to-uterine incision (I-U) time of $\leq$3 minutes. Subjects were dichotomized into those with an I-U time of $\leq$3 minutes or $\geq$5 minutes.

Results: 1722 patients underwent primary CD and met eligibility criteria. 72 patients with an I-U time of 4 minutes were removed from the analysis. 196 patients (11.9%) had an I-U time $\leq$3 minutes and 1454 patients (88.1%) had an I-U time $\geq$5 minutes. There were no differences in any outcomes between groups. The likelihood of transfusion, hysterectomy, or admission to the intensive care unit (ICU) was 1.5% in the emergent group and 1.0% in the control group ($p = .334$). Postpartum length of stay was also similar between the groups (3.3 versus 3.2 days, $p = .259$). When 384 patients with I-U times $>$10 minutes were excluded, surgical outcomes remained similar between groups. Among the subgroup of patients who reached the second stage of labor, surgical outcomes were also similar between groups.

Conclusions: Emergent primary CD is not associated with increased maternal morbidity.

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Cesarean section; second stage; surgical speed

Introduction

There are currently no definitive guidelines on how quickly a primary cesarean delivery (CD) should be performed. Despite a historical recommendation that hospitals providing obstetric services should have the capability to begin a CD within 30 minutes of the decision to perform one, the American Congress of Obstetricians and Gynecologists (ACOG) has acknowledged there is limited evidence to support this practice [1]. Beyond this recommendation, there is no consensus on the speed at which specific surgical steps should be performed to accomplish safe delivery of the neonate via CD. In cases of emergent repeat CD, data suggest that maternal outcomes may be adversely affected by shorter incision-to-delivery times [2]. Similar outcomes have not been examined in the case of primary CD. As of 2015, the primary cesarean section rate in the USA was approximately 21.8% [3]. Therefore, it is of major interest to know how surgical speed may affect the overall morbidity in this large population of women. Specifically, it is unknown if a "stat" or emergent CD done as rapidly as possible in an emergent situation to lower neonatal morbidity is associated with any maternal morbidity. Put another way, when we perform an emergent CD for fetal indications, is this done at the expense of maternal morbidity?

Our objective was to determine whether emergent primary CD is associated with adverse maternal outcomes. We hypothesized that a shorter skin incision-to-uterine (I-U) time would be associated with increased maternal morbidity.

Materials and methods

After Institutional Review Board approval, we reviewed the charts of all patients who were attempting a trial of labor and who underwent primary CD at The Mount Sinai Hospital during the years of 2011–2016. 2011 was

CONTACT Eric P. Bergh eric.bergh@mssm.edu Dept OB/GYN, second Floor, 5 E 98th St, New York, New York

chosen as the starting year as it is when our hospital converted to an electronic health record. The operations are typically performed by one resident and one attending surgeon, as it is a standard practice at our institution. Women with a singleton pregnancy and without a history of uterine scar (neither prior CD nor prior myomectomy) who were attempting a trial of labor were included in this analysis, if they underwent CD. Patients with documented abruption or bleeding disorder such as severe HELLP were removed from the analysis. I-U time was defined as the time interval in minutes between skin and uterine incisions, as recorded in the intraoperative record. The I-U time interval was chosen for this analysis to control for any possible confounding related to a difficult delivery of the fetus that might prolong an otherwise rapid surgical entry time. As surgical speed is not standardized, we defined an emergent CD *a priori* as an I-U time of 3 minutes or less. For a control group, we selected women with an I-U time of 5 minutes or more. Since I-U times in our database were rounded to the nearest minute, women with an I-U time of 4 minutes were not analyzed, due to the possibility that the actual I-U time could only be seconds different from the other two groups.

Subjects were dichotomized into those with an I-U time of $\leq$3 minutes or $\geq$5 minutes. Baseline characteristics and maternal outcomes were assessed between these two groups. We then repeated the analysis excluding all patients with I-U time $>$10 minutes to account for procedures which may have been otherwise complicated and not routine.

Finally, we performed a subgroup analysis of patients who reached the second stage of labor (full cervical dilation).

Maternal operative complications compared between the groups included time from uterine incision to the end of procedure (U-E), estimated blood loss (EBL), EBL $>$1000 cc, transfusion, hysterectomy, intensive care unit (ICU) admission, postpartum length of stay, and composite transfusion/hysterectomy/or ICU admission. Chi-square test, Fisher's exact test, and Student's *t*-test were used, as appropriate (SPSS for Windows 16.0, Chicago 2007).

We did not compare neonatal outcomes between the two groups, as it would be expected that short I-U times would be associated with adverse neonatal outcomes due to the indication for emergent delivery, as opposed to the actual speed of surgery.

Results

One thousand seven hundred twenty-two patients underwent primary CD during the study period and met all the eligibility criteria. Seventy-two patients with an I-U time of 4 minutes were removed from the analysis. In all, 196 patients (11.9%) had an I-U time $\leq$3 minutes and 1454 patients (88.1%) had an I-U time $\geq$5 minutes. Baseline characteristics are shown in Table 1. Race, maternal age, and body mass index (BMI) did not differ between the groups. Gestational age (GA) was greater in the $\geq$5 minutes group when compared to the $\leq$3 minutes group, but only by a few days (39.4 ± 2.0 v. 39.9 ± 1.5, $p < .001$).

Outcomes between these groups are shown in Table 2. No significant differences in any maternal outcomes were seen between the two groups. When the 384 patients with I-U times $>$10 minutes were excluded from the analysis, the total number of patients in our study population was 1266. One hundred ninety-six patients (15.5%) had an I-U time of $\leq$3 minutes and 1070 patients (84.5%) had an I-U time $\geq$5 and $\leq$10 minutes. All surgical outcomes were similar between the groups and are shown in Table 3.

In order to test our cutoff of 3 minutes, we compared rates of the composite outcome of hysterectomy, transfusion or ICU admission across 11 groups of patients, based on the number of minutes from skin incision to uterine incision (0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 minutes). There was no significant difference across the 11 groups (0, 0, 4.1, 0, 1.4%, 1.4, 0.6, 0.9, 0.5, 0.5%, 0%, respectively, *p* value for trend = .098).

A subgroup analysis was performed for patients who reached the second stage of labor. Overall, 347 patients were included (21% of all patients in the study) for this analysis and they were dichotomized by surgical speed (I-U time $\leq$3 minutes or $\geq$5 minutes). The groups differed by race while all other maternal demographics were similar (Table 4). Surgical outcomes were also similar between these two groups (Table 5).

Table 1. Baseline characteristics, all primary cesarean delivery (CD), based on skin-to-uterine incision time (I-U).

	I-U $\leq$3 minutes $N = 196$	I-U $\geq$5 minutes $N = 1454$	*p* Value
Race			.512
White	85 (43.3%)	728 (49.7)%	
African–American	36 (18.4%)	162 (11.0%)	
Asian	21 (10.7%)	165 (11.3%)	
Native American	0 (0.0%)	7 (0.5%)	
Other	54 (27.6%)	402 (27.5%)	
Age	31.2 ± 6.3	31.8 ± 5.9	.203
BMI	30.9 ± 5.8	31.4 ± 11.9	.535
Gestational age	39.4 ± 2.0	39.9 ± 1.5	<.001

CD: cesarean delivery; I-U: skin-to-uterine incision time; BMI: body mass index.

Table 2. Outcomes, all primary CD, based on skin-to-uterine incision time (I-U).

	I-U ≤ 3 minutes $N = 196$	I-U ≥ 5 minutes $N = 1454$	p Value
Time from uterine incision to operation end	50 ± 19	52 ± 16	.134
EBL	880 ± 208	882 ± 229	.918
EBL >1000 cc	13 (6.6%)	86 (5.9%)	.674
Transfusion	3 (1.5%)	11 (0.8%)	.263
Hysterectomy	2 (1.0%)	2 (0.1%)	.071
ICU	2 (1.0%)	8 (0.5%)	.334
Transfusion, Hysterectomy, or ICU	3 (1.5%)	15 (1.0%)	.462
PP length of stay	3.3 ± 0.7	3.2 ± 0.7	.259

CD: cesarean delivery; I-U: skin-to-uterine incision time; EBL: estimated blood loss; ICU: intensive care unit; PP: postpartum.

Table 3. Outcomes, all primary CD, based on skin-to-uterine incision time (I-U), excluding times >10 minutes.

	I-U ≤ 3 minutes $N = 196$	I-U 5–10 minutes $N = 1070$	p Value
U-E	50 ± 19	49 ± 14	.441
EBL	880 ± 208	865 ± 174	.334
EBL >1000 cc	13 (6.6%)	46 (4.3%)	.154
Transfusion	3 (1.5%)	4 (0.4%)	.079
Hysterectomy	2 (1.0%)	1 (0.1%)	.064
ICU	2 (1.0%)	4 (0.4%)	.235
Transfusion, hysterectomy, or ICU	3 (1.5%)	7 (0.7%)	.192
PP length of stay	3.3 ± 0.7	3.2 ± 0.7	.170

CD: cesarean delivery; I-U: skin-to-uterine incision time; U-E: time from uterine incision until end of procedure in minutes; EBL: estimated blood loss; ICU: intensive care unit; PP: postpartum.

Table 4. Baseline characteristics, fully dilated (FD) primary CD, based on skin-to-uterine incision time (I-U).

	I-U ≤ 3 minutes $N = 41$	I-U ≥ 5 minutes $N = 306$	p Value
Race			.001
White	21 (51.2%)	197 (64.4%)	
African–American	9 (22.0%)	10 (3.3%)	
Asian	3 (7.3%)	40 (13.0%)	
Native American	0 (0.0%)	1 (0.3%)	
Other	8 (19.5%)	58 (19.0%)	
Age	32.9 ± 4.9	32.4 ± 5.3	.605
BMI	29.7 ± 5.6	30.0 ± 9.3	.813
GA	39.8 ± 1.9	40.0 ± 1.1	.378

FD: fully dilated; CD: cesarean delivery; I-U: skin-to-uterine incision time; BMI: body mass index; GA: gestational age at delivery.

Table 5. Outcomes, FD primary CD, based on skin-to-uterine incision time (I-U).

	I-U ≤3 minutes $N = 41$	I-U ≥5 minutes $N = 306$	p Value
U-E	52 ± 24	54 ± 18	.407
EBL	873 ± 175	897 ± 194	.457
EBL >1000 cc	4 (9.8%)	26 (8.5%)	.768
Transfusion	0 (0.0%)	1 (0.3%)	.999
Hysterectomy	0 (0.0%)	0 (0.0%)	NA
ICU	0 (0.0%)	2 (0.7%)	.999
Transfusion, hysterectomy, or ICU	0 (0.0%)	2 (0.7%)	.999
PP length of stay	3.3 ± 0.7	3.2 ± 0.6	.138

FD: fully dilated; CD: cesarean delivery; I-U: skin-to-uterine incision time; U-E: time from uterine incision until end of procedure in minutes; EBL: estimated blood loss; ICU: intensive care unit; PP: postpartum.

Comment

In this study, we found that in patients undergoing a trial of labor who ultimately deliver *via* primary CD, an emergent CD, defined as an I-U time of 3 minutes or less, was not associated with any increased maternal morbidity. When patients with an I-U time in excess of 10 minutes were removed from the analysis, surgical outcomes remained the same between the groups. We also found that among women who had a CD at full cervical dilation, an emergent CD was not associated with increased maternal morbidity.

In spite of the recommendation to commence emergent CD within 30 minutes of decision to operate, multiple studies have shown no difference in adverse neonatal outcomes when the decision-to-incision time is in excess of 30 minutes [4–7]. Therefore, with the exception of very rare events such as cord prolapse or terminal bradycardia, the decision to proceed with an emergent CD to improve neonatal outcomes frequently may not be indicated. As the greatest urgency in an emergent CD is placed on an expedient surgical entry, it is interesting to find that in our population variations in time from incision-to-uterine did not adversely affect maternal morbidity. Although gestational age was greater when I-U time was ≤5 minutes, a difference of 39.4 ± 2.0 versus 39.9 ± 1.5 weeks may not be clinically significant and was not associated with increased rates of adverse outcomes. Additionally, while race was significantly different among groups who reached the second stage, surgical outcomes were unaffected.

There is currently a lack of comprehensive data on maternal outcomes related to surgical speed at time of primary CD. In a large 2010 MFMU trial, 2107 patients with Pfannenstiel incisions undergoing emergent primary CD had a median operative time from incision-to-delivery of 4.0 minutes (interquartile range 2.0–7.0) [8]. However, in that study surgical outcomes were compared by skin incision type (transverse versus vertical) and not by surgical speed. In a more recent study by Moroz et al., patients who underwent emergent repeat cesarean delivery with an incision-to-fetal delivery time of $\leq$2 minutes had an increased composite surgical morbidity [2]. One may assume that the same findings would be applicable in cases of primary CD. However, the findings by Moroz et al. are likely explained by the challenges of performing safe surgical dissection at speed in patients with adhesive disease from prior surgery. The same surgical obstacles were not present in our population of women undergoing primary CD and with no prior history of uterine surgery.

It is well-known that CD performed in the second stage of labor is associated with increased maternal morbidity including longer overall operative time and postoperative endometritis [9–11]. However, outcomes relating to variations in surgical entry time within this population have not been previously examined. Our results indicate that the maternal morbidities of interest are not affected by I-U time. We suspect that major maternal morbidity in this population may be unrelated to surgical time but rather to intrapartum factors such as a prolonged second stage and the use of labor augmentation. However, due to the smaller sample size of this subgroup in our cohort, we may have been underpowered to detect any differences for women undergoing emergent CD in the second stage.

A limitation of this study is the retrospective design. However, any prospective study of operative time would be observational as surgical speed cannot be randomized. In addition, these findings represent outcomes from a single academic care center. Therefore, our findings may not be applicable to other populations and further studies should include patients with increasing degrees of obesity. Furthermore, our results may be affected by interphysician variability. Also, in the absence of formal guidelines describing the surgical speed at which an emergent CD should be performed, our decision to define a "stat" CD $\leq$3 minutes is arbitrary and a potential limitation. Lastly, we did not look at all possible surgical outcomes. Future studies may benefit from a broader composite outcome to further elucidate the effect of surgical time on maternal morbidity.

In conclusion, in patients undergoing a trial of labor who deliver *via* primary CD, an emergent CD does not appear to be associated with increased maternal morbidity. This finding holds true even in cases of CD performed in the second stage of labor.

Disclosure statement

The authors report no conflicts of interest.

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