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Adverse pregnancy outcomes related to preterm cesarean delivery

Tamina Kino[a], Yuriko Yamamoto[a,*], Yusuke Saigusa[b], Shigeru Aoki[a], Etsuko Miyagi[c]

[a] Perinatal Center for Maternity and Neonate, Yokohama City University Medical Center, Yokohama, 4-57 Urafunecho, Minami-ku, Yokohama City, Kanagawa 232-0024, Japan
[b] Department of Biostatistics, Yokohama City University School of Medicine, Japan
[c] Department of Obstetrics and Gynecology, Yokohama City University School of Medicine, Japan

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ABSTRACT

Objective: Cesarean delivery at a preterm gestational age has been related to maternal complications such as bleeding and infection. However, previous reports are conflicting, and there is no consensus on the matter. We aimed to clarify the adverse effect of preterm cesarean delivery with an emphasis on maternal bleeding.

Study design: We conducted a retrospective study comparing the frequency of maternal adverse outcome between preterm emergency cesarean delivery and term emergency cesarean delivery. Nine hundred and forty seven preterm cases and 1056 full-term cases were included in the study. We analyzed the frequency of abnormal bleeding defined as 1500 mL or more as primary outcome, blood transfusion rate, and rate of postoperative administration of antibiotics as secondary outcome. Logistic regression analysis was performed for confounding variables; age at delivery, primiparity, obesity, prior history of uterine surgery, abnormal placental position, abnormal glucose tolerance, hypertension during pregnancy, early rupture of membranes, and general anesthesia use during operation. As secondary analysis, to study the effects of method of incision, we compared adverse outcomes among classical cesarean delivery, inverted T incision, and upper segment incision within preterm emergency cesarean delivery.

Results: Preterm cesarean delivery had significantly higher rates of abnormal bleeding, transfusion and use of antibiotics than term cesarean delivery. Among the preterm delivery, classical incision was related to increased rate of blood transfusion and need for antibiotic treatment.

Conclusion: Preterm cesarean delivery increases the risk of maternal bleeding. This should be considered especially in the setting of early preterm birth.

Introduction

When early preterm delivery cannot be avoided, many reports have shown that if cesarean delivery is not otherwise indicated besides prematurity, cesarean does not improve neonatal outcome [1,2]. However, due to a theoretical benefit for the child, its proportion is reportedly as high as 57% [1,3]. On the other hand, few reports address maternal complications due to preterm cesarean deliveries, and the adverse effect to the mother remains poorly understood [4,5].

Cesarean delivery at a preterm gestational age has been implicated in possibly increasing the frequency of various maternal complications. It has been reported that in cesarean delivery from weeks 25–34, classical cesarean delivery had a significant increase in blood loss, blood transfusion rate, sepsis, postoperative pain, and dehiscence of uterine incision in the next pregnancy compared to those after lower segment cesarean delivery [6–8]. Meanwhile, a comparison of cesarean delivery from weeks 24–36, between classical cesarean delivery and lower segment cesarean delivery, reportedly did not show a significant difference in postoperative bleeding, rate of transfusion, infection, intestinal obstruction, or short-term maternal complications until discharge from the hospital [9]. Thus, there is a lack of consensus on how cesarean delivery at a preterm gestational age affect the mother.

To clarify the adverse effect of preterm cesarean delivery, with an emphasis on bleeding, we conducted a retrospective study comparing adverse maternal events for term emergency cesarean delivery and preterm emergency cesarean delivery.

Materials and methods

This is a retrospective study investigating the frequency of maternal adverse events in patients who delivered a singleton by emergency cesarean delivery at Yokohama City University Medical

* Corresponding author.
E-mail address: yyyama@yokohama-cu.ac.jp (Y. Yamamoto).

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Center's Perinatal Center for Maternity and Neonates between January 2000 and May 2017. The control group consisted of patients who delivered at term by emergency cesarean delivery. Patients with serious complications that affected cardiac function, renal function, or respiratory function were excluded, as were patients with unstable complications, such as uncontrolled epilepsy or coagulation disorders.

The primary outcome was the incidence of abnormal bleeding. Abnormal bleeding during cesarean delivery was defined as 1500 mL or more of blood loss, including amniotic fluid. Secondary outcomes were blood transfusion rate and rate of postoperative administration of antibiotics. Transfusions included red blood cells, fresh frozen plasma, and platelets, but excluded autotransfusions. Indication of blood product use was at the attending physician's discretion, considering vital signs, total blood loss, and the extent of postoperative anemia. Antimicrobial drugs were administered after surgery at the discretion of the attending physician.

Logistic regression analysis was performed with confounding variables as follows; age at delivery, primiparity, obesity, prior history of uterine surgery, abnormal placental position, abnormal glucose tolerance, hypertension during pregnancy, early rupture of membranes, and general anesthesia use during operation.

Confounding factors were defined as follows. Obesity was defined as a BMI at delivery of 30 or higher. Uterine surgery included cesarean delivery and myomectomy. Abnormal placental position included placenta previa as well as low-lying placenta with a distance of less than 2 cm from the internal orifice to the margin of the placenta. Abnormal glucose tolerance was defined as gestational diabetes, obvious diabetes diagnosed during pregnancy, or diagnosis predating pregnancy. Hypertension during pregnancy included cases of systolic blood pressure 140 mmHg or diastolic blood pressure 90 mg or higher in pregnancy after 20 weeks. Patients were diagnosed with essential hypertension before pregnancy were also included.

To study the effects of the method of incision on the occurrence of adverse events in preterm cesarean delivery, as a secondary analysis, we performed a logistic regression analysis adjusting for background factors for primary and secondary outcomes, solely for preterm emergency cesarean delivery, with different methods of incision—classical cesarean delivery, inverted T incision, and upper segment incision.

Data is represented as mean (expected value), standard deviation, or frequency (percentage). The statistical software used for statistical analysis was JMP Pro12 (Cary, NC 27513). One-way analysis of variance and Pearson's χ^2 test were used to compare respective backgrounds and results. The level of statistically significant difference was set at $p < 0.05$. Logistic regression analysis was used to adjust for confounding variables; the odds ratio (ORs) and 95% confidence interval (CIs) were also estimated.

Results

There were 2636 preterm delivery of singletons by emergency cesarean delivery at Yokohama City University Medical Center's Perinatal Center for Maternity and Neonates during the study period. Of these, 2003 met the inclusion criteria—947 preterm cases, and 1056 full-term cases. Table 1 shows the backgrounds of the two groups. The median age was 33 years for both preterm and full-term births. Confounding factors with significant difference were primiparity, history of uterine surgery, abnormal placental position, hypertension during pregnancy, early rupture of membranes, and the use of general anesthesia.

Before adjusting for confounding factors, preterm cesarean delivery had significantly more blood loss >1500 mL and a significantly higher transfusion rate, at 9.7% and 9.0% respectively, as compared to full-term births, at 4.8% and 3.0%, but the use of antimicrobial drugs did not show a significant difference between full-term births (23.4%) and preterm births (24.6%) (Table 2). Logistic regression analysis adjusting for confounding factors showed that the odds ratios for preterm blood loss >1500 mL, transfusion rate, and use of antimicrobial drugs were significantly higher in preterm births—at 1.9, 1.9, and 1.3, respectively, than in full-term births (Table 2).

Of the 947 preterm emergency cesarean deliveries, there were 799 lower segment incisions, 95 classical incisions, 35 inverted T incisions, and 18 upper segment incisions. Three incision methods—classical incision, inverted T incision, and upper segment incision—were compared by frequency of adverse events with lower segment incisions (Table 3). Classical incisions tended to have a higher rate of transfusion and use of antimicrobial drugs. Inverted T incisions had a higher frequency of use of antimicrobial drugs. Upper segment incisions had no difference in adverse events as compared to lower segment incisions. Logistic regression analysis adjusting for confounding factors on each method of incision (Table 3) showed that classical cesarean delivery had an odds ratio of 2.5 and 2.6 for the rate of transfusion and use of antimicrobial drugs, respectively. The significant difference in frequency of adverse events between the inverted T incision and upper segment incision disappeared as a result of the regression analysis.

Table 1
Patient background.

	Preterm births (n = 947)	Full-term births (n = 1056)	P value
Age (years)	32.9 ± 0.17	33.0 ± 0.16	0.73
Primiparity	51.2%	72.0%	<0.001*
BMI at delivery > 30	10.9%	13.0%	0.15
Prior history of uterine surgery	22.1%	17.8%	0.017*
Abnormal placental position	7.8%	1.1%	<0.001*
Abnormal glucose tolerance	7.6%	9.7%	0.10
Hypertension during pregnancy	32.4%	12.0%	<0.001*
Premature rupture of membranes	23.3%	35.6%	<0.001*
General anesthesia	21.7%	11.8%	<0.001*

Table 2
Logistic regression analysis for blood loss >1500 mL, frequency of transfusion, and frequency of use of antimicrobial drugs.

	Preterm births (n = 947)		Term births (n = 1056)		P value
	Freq.	Odds ratio (CI)	Freq.		Odds ratio
Blood loss >1500 mL	9.7%	1.9 (1.27–2.85)	4.8%	Ref 1	0.0018*
Blood transfusion	9.0%	1.9 (1.18–3.07)	3.0%	Ref 1	0.0076*
Use of antibiotics	25%	1.3 (1.05–1.67)	23%	Ref 1	0.0167*

Adjusted variables: age at delivery, primiparity, obesity, prior history of uterine surgery, abnormal placental position, abnormal glucose tolerance, hypertension during pregnancy, early rupture of membranes, and general anesthesia use during operation.

Table 3
Logistic regression analysis of blood loss >1500 mL, frequency of transfusion, and frequency of use of antimicrobial drugs between preterm classical, inverted T, upper segment and lower segment incision.

	Classical cesarean delivery (n = 95)		Lower segment (n = 799)		P value
	Inverted T incision (n = 35)				
	Upper segment (n = 18)				
	Freq.	Odds ratio	Freq.		
Blood loss >1500 mL	7.4%	0.7 (0.27–1.50)	10%	Ref 1	0.36
	11%	1.5 (0.39–4.34)			0.54
	5.6%	0.3 (0.017–2.05)			0.27
Blood transfusion	16%	2.5 (1.23–4.92)	8.5%	Ref 1	0.012*
	5.7%	0.8 (0.12–3.34)			0.83
	0%	—			—
Use of antibiotics	42%	2.6 (1.60–4.09)	22%	Ref 1	<0.001*
	37%	2.1 (0.96–4.53)			0.061
	39%	2.8 (0.94–7.67)			0.063

Adjusted variables: age at delivery, primiparity, obesity, prior history of uterine surgery, abnormal placental position, abnormal glucose tolerance, hypertension during pregnancy, early rupture of membranes, and general anesthesia use during operation.

Comment

The present study shows that preterm emergency cesarean delivery poses a greater risk of bleeding and infection than emergency cesarean delivery in term births. Specifically, the rate of blood loss being 1500 mL or greater, the rate of transfusion, and the rate of postoperative use of antimicrobial drugs were all higher than for full-term births. Studying different methods of uterine incisions, specifically for preterm emergency cesarean delivery, revealed that classical incisions had a higher rate of transfusion and higher rate of postoperative use of antimicrobial drugs as compared to lower segment incisions.

Firstly, the reported increase in bleeding and transfusions is largely consistent with previous reports. Reddy et al. [4] reported that, compared to preterm vaginal deliveries, preterm cesarean delivery had a higher risk of bleeding, with three definitions: 1500 mL or more of bleeding, transfusion, and hysterectomy due to bleeding. Lao et al. [6] reported that preterm cesarean delivery is associated with more blood loss because the lower uterine segment is poorly formed and more vascular in preterm. And Combs et al. [10] reported that preterm delivery itself increased the odds ratio of hemorrhage.

Secondly, in the investigation limited to preterm emergency cesarean delivery, the present study showed that classical cesarean deliveries had a higher rate of transfusion and rate of postoperative use of antimicrobial drugs than that in lower segment incisions. There has been inconsistent data from previous studies on complications by method of incision. Halperin et al. [11] compared 163 classical incisions and 163 lower segment incisions, and reported that there was no difference in frequency of bleeding ≥ 1000 mL or transfusion observed between the two groups. Meanwhile, Lao et al. [6], compared 31 classical incisions and 31 lower segment incisions with matched backgrounds among cases that underwent cesarean delivery in weeks 25–34, and reported that classical incisions had a higher frequency of bleeding ≥1000 mL, and significantly lower postoperative hemoglobin levels. Neither group had any cases requiring transfusion. Patterson et al. [12] reported that classical incisions and inverted T incisions had higher rates of transfusion and postoperative infection as compared to lower segment incisions, covering preterm and full-term births, and Yogesh et al. [9] reported that in cesarean delivery from weeks 24–36, a comparison of 101 lower segment incisions and 77 classical incisions showed no difference in estimated blood loss, but the rate of transfusion in classical incisions were higher. They also reported no difference in the postoperative use of antimicrobial drugs. In the study by Patterson et al. [12], the cases with classicsal incisions or inverted T incisions are more frequent in preterm births, which supports the results of this study. The study by Yogesh et al. [9] also showed similar results for mean blood loss, but a higher rate of transfusion, which is consistent with the present study. Research by Lao et al. [6], who compared preoperative and postoperative hemoglobin levels, also suggested that reasons for the difference in the rate of transfusion despite no difference in blood loss in preterm cesarean delivery may include the fact that the amount of circulating plasma has not yet increased, especially in early preterm births; thus, anemia follows a more severe progression even with equivalent amounts of blood loss. And Kawakita et al. [5] reported there was no difference in blood transfusion and ICU admission rate from 23 to 27 weeks between classical cesarean delivery and lower segment incision, but from 28 to 31 weeks, classical cesarean delivery was higher than lower segment incision. They speculated that it was because lower segment was not distended from 23 to 27 weeks and the risk of incision to the fundus and the lower segment was relatively equivalent.

The present study has two limitations. The first is that indications for emergency cesarean delivery were not examined. Thus, it is possible that the pathologies for which preterm cesarean delivery is indicated included factors leading to excessive bleeding. Second, because postoperative antimicrobial drugs were administered at the attending physician's discretion, it is possible that the criteria for administration did not reflect the true risk of infection. However, the present study has a relatively large sample size, including cases from early preterm births at week 22, and showed, even adjusting for background factors leading to excessive bleeding, that preterm cesarean delivery pose a greater risk for excessive maternal bleeding than cesarean delivery in full-term births.

To conclude, the present study shows that preterm cesarean deliveries have more bleeding and a higher rate of transfusion associated as compared to cesarean deliveries in term births. In particular, a classical incision has been shown to increase this risk. These adverse effects should be considered especially in the setting of early preterm birth.

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