

Mode of Delivery and Outcomes in Preterm Births

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Objective: To compare maternal and neonatal outcomes by mode of delivery in preterm births.

Material and Method: This prospective study was a part of SEA-ORCHID project of 9,263 pregnant women. The subjects were all women admitted for preterm birth (20 to 36 weeks) in nine hospitals in four Southeast Asian countries (Thailand, Malaysia, Indonesia, and the Philippines) between June 2007 and December 2009. Deliveries were classified into vaginal delivery and caesarean delivery. We obtained data from women's medical and delivery records.

Results: There were 765 preterm births in this analysis, 294 (38.4%) were delivered by caesarean section with a mean weight of $1,988 \pm SD 629$ g and 471 (61.6%) were delivered vaginally with a mean weight of $1,982 \pm SD 699$ g. There were two maternal deaths in caesarean delivery group. Caesarean delivery was significantly associated with increased risk of blood loss > 500 ml and > 1,000 ml, adjusted ORs: 11.7, CI 95%: 5.7-24.1 and 12.0, CI 95%: 2.2-65.3, respectively. Infants delivered vaginally had a significantly shorter length of hospital stay than infant delivered by caesarean delivery (adjusted mean difference 3.4, CI 95%: 1.2-5.5). The risk of respiratory distress syndrome, birth asphyxia (low Apgar scores (< 7) at 5 minutes) and early neonatal death were not statistically different between caesarean delivery and vaginal delivery.

Conclusion: In preterm births, caesarean delivery significantly increases the risk of postpartum hemorrhage and had longer neonatal length of hospital stay compared to vaginal delivery.

Keywords: Maternal outcomes, Mode of delivery, Neonatal outcomes, Preterm births

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Preterm birth is defined as the delivery of an infant occurring at less than 37 completed weeks⁽¹⁾. Preterm birth occurs in 5% to 10% of all pregnancies and is the most common cause of perinatal morbidity and mortality in the world, mainly because of respiratory distress syndrome, sepsis, and low birth weight^(2,3). Provision of care for adverse sequelae of preterm newborns has enormous burden on the healthcare system⁽⁴⁾.

Mode of delivery is one of major concern in modern obstetrics in preterm birth. Mode of delivery depends on obstetric indications, severity of maternal diseases and facility of hospital. The recommendation of mode of delivery in preterm birth remained controversial and not yet clearly established. Some studies showed a significant beneficial effect of caesarean delivery on neonatal mortality^(5,6). Other

studies reported that mode of delivery affected very little adverse neonatal outcomes, either mortality or psychomotor outcomes^(7,8). While a possible positive effect of caesarean delivery exists for the fetus, the maternal morbidity is increased following caesarean delivery. The most common causes were hemorrhage and infectious morbidity⁽⁹⁾. There are limited studies evaluating the association between mode of delivery and maternal and neonatal outcomes in preterm birth. The purpose of this study was to compare maternal and neonatal outcomes between modes of delivery in preterm births.

Material and Method

This prospective study was a part of optimizing reproductive and child health outcomes by building evidence-based research and practice in South East Asia (SEA-ORCHID) project that was conducted in 9,263 pregnant women between June, 2007 and December, 2008 from nine hospitals participating of four South East Asian countries (Thailand, Malaysia, Indonesia and the Philippines).

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The SEA-ORCHID project settings and methods have been described elsewhere⁽¹⁰⁾. The study was approved by the local ethics committee of each hospital.

The authors analyzed data of preterm births with gestational age between 20 and 36 weeks. Gestational age was determined by the exact last menstrual period or early ultrasonography. All included cases were classified according to the mode of delivery, vaginal and caesarean delivery. Vaginal delivery included spontaneous vertex and assisted/instrumental delivery such as vacuum, forceps and breech. Data included maternal and neonatal demographic characteristics and outcomes up to hospital discharge.

Maternal outcomes of blood loss, infection, length of hospital stay (LOS) and maternal death were assessed. Neonatal outcomes of birth weight, respiratory distress syndrome, Apgar scores at five minutes < 7, length of hospital stay (LOS) and early neonatal death were also evaluated.

Statistical analysis

The authors used frequencies to describe categorical data such as parity, mode of delivery, obstetric complications etc. Means and standard deviations were used to describe the continuous data of maternal age, birth weight and LOS. The authors calculated crude odds ratios (OR) and their 95% confidence intervals (CIs) of maternal and neonatal outcomes across mode of delivery. The authors estimated adjusted ORs and 95% CIs controlled for parity, antenatal corticosteroids, maternal age, gestational age at birth, maternal complications and country using multiple logistic regression. Differences in maternal and neonatal LOS were also analyzed using multiple linear regressions adjusted for the same variables. The analysis was performed using STATA version 10 software.

Results

From the 9,263 pregnant women, 765 preterm births were recruited, including 471 (61.6%) vaginal deliveries and 294 (38.4%) caesarean deliveries as shown in Fig. 1. Distributions of the study women by countries are shown in Table 1. Malaysia had the highest numbers of preterm births (32.8%), whereas the Philippines had the lowest numbers of participants (19.3%). Vaginal deliveries were more often than caesarean deliveries in all countries.

Characteristics of parity and gestational age were similar in both groups. Non-vertex presentation

Table 1. Distribution of women who had preterm births

	Vaginal delivery n (%)	Cesarean delivery n (%)	Total
Thailand	105 (57.1)	79 (42.9)	184
Malaysia	163 (64.9)	88 (35.1)	251
Indonesia	117 (64.3)	65 (35.7)	182
Philippines	86 (58.1)	62 (41.9)	148
Total	471 (61.6)	294 (38.4)	765

at delivery was more common in the caesarean deliveries (14.3% vs. 6.6%). Spontaneous preterm labor was the common cause of preterm birth in both groups. Women delivered by caesarean section had more pre-eclampsia, antepartum hemorrhage and fetal distress than women delivered vaginally. Women in the caesarean deliveries were slightly older (mean age; $29.8 \pm \text{SD } 6.6$ years vs. $27.8 \pm \text{SD } 6.4$ years) and more likely to receive prenatal steroid administration (43.8% vs. 29.4%) (Table 2).

Regarding maternal outcomes, two maternal deaths were reported in caesarean delivery group. Autopsy was not performed and the causes of death were reported to be pulmonary edema in one case and unknown for the other. They were over twelve times of postpartum blood loss > 500 and > 1,000 ml in pregnant women delivered by caesarean section (adjusted OR: 11.7, CI 95%: 5.7-24.1), (adjusted OR: 12.0, CI 95%: 2.2-65.3), respectively. Risk of puerperal infection and maternal LOS were not significantly increased by caesarean delivery (adjusted OR: 1.3, CI 95%: 0.8-2.2), (adjusted mean difference 1.8, CI 95%: 0.3-3.3), respectively (Table 3).

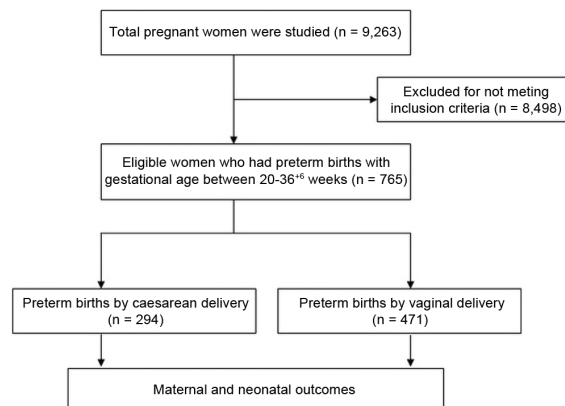


Fig. 1 Flowchart of the study eligible cohort

Table 2. Characteristics of women with preterm birth by mode of delivery

	Vaginal delivery (n = 471) Mean \pm (SD) or n (%)	Caesarean delivery (n = 294) Mean \pm (SD) or n (%)	Total (n = 765) Mean \pm (SD) or n (%)
Maternal age (yr)			
< 20	54 (11.5)	18 (6.2)	72 (9.4)
20-34	324 (69.1)	189 (64.7)	513 (67.1)
> 35	93 (19.8)	87 (29.8)	180 (23.5)
Primigravida	236 (50.3)	140 (47.9)	376 (49.2)
Gestational age (weeks)	33.3 (3.3)	33.7 (2.5)	33.4 (3.0)
20-24	16 (3.4)	2 (0.7)	17 (2.2)
25-29	50 (10.7)	20 (6.8)	70 (9.2)
30-34	161 (34.3)	130 (44.5)	291 (38.0)
> 35	245 (52.2)	142 (48.6)	387 (50.6)
Steroid administration	138 (29.4)	128 (43.8)	266 (34.8)
Reason at risk of preterm birth*	(n = 415)	(n = 287)	(n = 702)
Spontaneous preterm labor	246 (59.3)	108 (37.6)	354 (50.4)
Prelabour rupture of the membranes	90 (21.7)	38 (13.2)	128 (18.2)
Preeclampsia	22 (5.3)	71 (24.7)	93 (13.2)
Antepartum hemorrhage	4 (0.9)	27 (9.4)	31 (4.4)
Fetal distress	1 (0.2)	4 (1.4)	5 (0.7)
Other complications	52 (12.5)	39 (13.6)	91 (12.9)
Operative vaginal delivery	44 (9.4)	NA	44 (9.4)

* There were some missing data for unknown reason of preterm birth

NA = not applicable

Table 3. Mode of delivery and pregnancy outcomes*

Variables	Vaginal delivery Mean \pm (SD) or n (%)	Caesarean delivery Mean \pm (SD) or n (%)	Crude OR (95% CI) or mean difference (95% CI)	Adjusted OR (95% CI) or mean difference (95% CI)
Estimated blood loss (ml)				
< 500	426 (90.8)	174 (59.6)	1	1
500-1,000	43 (9.2)	118 (40.4)	6.6 (4.4-10.2)	11.7 (5.7-24.1)
> 1,000	3 (0.6)	10 (3.4)	8.2 (2.1-46.5)	12.0 (2.2-65.3)
Maternal infection	117 (37.8)	135 (46.6)	1.4 (1.1-1.9)	1.3 (0.8-2.2)
Maternal LOS (days)	3.8 (6.3)	7.2 (12.3)	3.5 (2.1-4.8)	1.8 (0.3-3.3)
Birthweight (g)				
< 1,000	51 (11.8)	12 (4.1)	0.8 (0.4-1.6)	0.8 (0.3-2.4)
1,001-1,500	75 (15.9)	62 (21.1)	1.6 (1.1-2.4)	1.3 (0.8-2.1)
1,501-2,500	239 (50.7)	162 (55.1)	0.9 (0.7-1.3)	1.1 (0.7-1.5)
> 2,500	106 (22.5)	58 (19.7)	1	1
Respiratory distress syndrome	114 (28.1)	105 (36.6)	1.5 (1.1-2.0)	1.2 (0.8-1.8)
Apgar score < 7 at 5 min	42 (10.5)	35 (12.5)	1.2 (0.7-1.9)	1.4 (0.8-2.4)
Neonatal LOS (days)	8.7 (11.0)	13.3 (16.8)	4.7 (2.6-6.7)	3.4 (1.2-5.5)
Early neonatal death	18 (4.4)	13 (4.5)	1.0 (0.5-2.1)	0.6 (0.2-1.5)

* Adjusted for antenatal corticosteroids, maternal age, parity, gestational age at birth, maternal complications, and country
LOS = length of stay

Infants in caesarean delivery had similar birth weights compared to vaginal delivery group (mean birthweight; 1,988 \pm SD 629 g vs. 1,982 \pm SD 699 g).

The majority of infants in both groups were born at gestational age > 35 weeks (50.6%). Neonatal death up to hospital discharge was not significantly different

between two groups (adjusted OR: 0.6, CI 95%: 0.2-1.5). Infants delivered vaginally had a significantly shorter LOS than infant born by caesarean delivery (adjusted mean difference 3.4, CI 95%: 1.2-5.5). The risk of respiratory distress syndrome, fetal hypoxia (Apgar scores (< 7) at 5 minutes) were not statistically different between the two groups of infants (Table 3).

Discussion

Among preterm births, caesarean delivery significantly increases maternal and neonatal adverse outcomes. Two maternal deaths were reported in caesarean delivery. Caesarean deliveries significantly increased the risk of postpartum hemorrhage (blood loss > 500 ml in vaginal delivery or > 1,000 ml in caesarean delivery)⁽¹¹⁾ and neonatal LOS.

Our results are consistent with findings of previous studies⁽¹²⁻¹⁴⁾ that caesarean delivery in preterm births did not show beneficial in neonatal outcomes and increased maternal morbidities.

The present study showed two maternal deaths in caesarean delivery when no death was reported in vaginal deliveries. This finding is consistent with result from previous studies⁽¹⁵⁻¹⁷⁾. However, there was no definitive autopsy to confirm whether the causes of these maternal deaths were directly related to caesarean delivery or maternal underlying conditions⁽¹⁸⁾.

The authors found that the risk of intra-operative blood loss was significantly higher after caesarean delivery. One study found an average blood loss of 460 mL for caesarean delivery⁽¹⁹⁾. Intraoperative blood loss > 1,000 ml in this study (3.4%) was lower than those reported from van Ham (7.3%)⁽²⁰⁾. Estimation of surgical blood loss is often inaccurate and is probably more often underestimated than overestimated⁽²¹⁾. This is reflected in our study that several women in caesarean deliveries (20 cases; 6.8%) received blood transfusion, although blood loss was estimated to be < 1,000 ml.

Despite previous study⁽²²⁾ that reported the benefit of a vaginal delivery including shorter maternal LOS, it was not confirmed in the present study. This might be because of differences in practices between the two settings. However, in the present study neonatal LOS in caesarean deliveries was significantly longer than vaginal delivery. LOS should be based on the health and well-being of the infant and mother, the ability and confidence of the mother to care for her infant, the adequacy of support systems at home and access to appropriate follow-up care^(23,24). A possible explanation might be because of higher proportion of

respiratory distress syndrome and fetal hypoxia (Apgar scores (< 7) at 5 minutes) in caesarean delivery than in vaginal delivery.

The strength of the present study is the prospective multicenter design of the study, in which the authors have set up a mechanism to collect completed information. The multicenter approach allows us to obtain a large number of 765 preterm births in only two years compared to the previous study that included only 109 cases in 17 years⁽¹²⁾. Regarding the limitation of the present study, the authors had some information about pregnancy outcomes only until discharge from hospital; some outcomes such as postpartum maternal infections, late neonatal death, etc. might have been underestimated. However, the authors believed that this should be minimal. The authors did not include stillbirth as one of our outcomes because the majority of stillbirths occurred in the antepartum period, which is not associated with mode of delivery.

Conclusion

The present study supports the evidence that in preterm births, caesarean delivery significantly increases risk of postpartum hemorrhage and had longer neonatal length of hospital stay compared to vaginal delivery.

Acknowledgments

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Potential conflicts of interest

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ชนิดของการคลอดต่อผลลัพธ์ของการตั้งครรภ์ในการคลอดก่อนกำหนด

อุษณีย์ สังคมกำแหง, พอใจ พัทธนิยธรรม, มาลินี เหล่าไพบูลย์, ภิเศก ลุ่มพิกานนท์

วัตถุประสงค์: เพื่อเปรียบเทียบผลของชนิดของการคลอดต่อมารดาและทารกในการคลอดก่อนกำหนด

วัสดุและวิธีการ: การศึกษานี้เป็นส่วนหนึ่งของงานวิจัย SEA-ORCHID (Optimising reproductive and child health outcomes by building evidence-based research and practice in South East Asia) ที่ศึกษาในสตรีตั้งครรภ์ทั้งหมด 9,263 คน เป็นศึกษาเชิงพรรณนาแบบไปข้างหน้าในหญิงตั้งครรภ์ที่คลอดก่อนกำหนด (20-36⁺6 สัปดาห์) ที่คลอดในโรงพยาบาลจากประเทศไทย มาเลเซีย อินโดนีเซีย และฟิลิปปินส์ ระหว่างเดือนมิถุนายน พ.ศ. 2550 ถึงเดือนธันวาคม พ.ศ. 2551 ชนิดของการคลอดแบ่งเป็นการคลอดทางช่องคลอดและการผ่าตัดคลอดทางหน้าท้อง ข้อมูลได้จากบันทึกของเวชระเบียนและบันทึกคลอด

ผลการศึกษา: สตรีคลอดก่อนกำหนด 765 ราย คลอดโดยการผ่าตัดคลอด 294 ราย (38.4%) และคลอดทางช่องคลอด 471 ราย (61.6%) พบน้ำหนักทารกแรกเกิดเฉลี่ย (1,988 ± 629 กรัม) และ (1,982 ± 699 กรัม) ตามลำดับ มารดาเสียชีวิต 2 ราย ในการผ่าตัดคลอด พบการผ่าตัดคลอดมีความสัมพันธ์กับปริมาณเลือดมากกว่า 500 และ 1,000 มิลลิลิตร (adjusted OR: 11.7, CI 95%: 5.7-24.1), (adjusted OR: 12.0, CI 95%: 2.2-65.3) ตามลำดับ ระยะเวลาอนโรงพยาบาลของทารกที่คลอดทางช่องคลอดน้อยกว่าทารกคลอดโดยการผ่าตัดคลอด (adjusted mean difference 3.4, CI 95%: 1.2–5.5) ส่วนภาวะหายใจล้มเหลว ภาวะทารกแรกเกิดขาดออกซิเจน (Apgar scores (< 7) ที่ 5 นาที) และอัตราการเสียชีวิตในระยะแรกไม่แตกต่างระหว่างทารกที่คลอดโดยการผ่าตัดคลอด และคลอดทางช่องคลอด

สรุป: ในการคลอดก่อนกำหนดพบว่าการผ่าตัดคลอดเพิ่มความเสี่ยงต่อการตกเลือดหลังคลอดและระยะเวลาอนโรงพยาบาลของทารก
