Neonatal Morbidity and Mortality for Repeated Cesarean Section vs. Normal Vaginal Delivery to Uncomplicated Term Pregnancies at Srinagarind Hospital

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Objective: *To evaluate the morbidities and mortality of neonates delivered by elective repeated cesarean section vs. normal vaginal delivery among women with uncomplicated term pregnancies.*
Material and Method: *A retrospective descriptive study was done between January 2009 and December 2011 to determine the morbidities and mortality among uncomplicated term pregnancies at Srinagarind Hospital. Three hundred seventy two neonates delivered by elective repeated cesarean section vs. 1,581 by normal vaginal delivery.*
Results: *A significantly greater number of neonates in the elective repeated cesarean section group required oxygen for neonatal resuscitation compared to neonates in the normal vaginal delivery group (37.6% vs. 20.9%, p<0.001). Neonates delivered by elective repeated cesarean section were more frequently admitted to the neonatal intensive care unit (1.1% vs. 0%, p<0.001) and had longer hospital stays (4.56±2.45 vs. 4.07±1.44 days, p<0.001). The latter not only had a higher rate of respiratory distress syndrome (0.8% vs. 0%, p<0.001) and transient tachypnea of the newborn (3.2% vs. 0.3%, p<0.001), which required more respiratory support, they also had a higher rate of infection (2.4% vs. 0.8%, p<0.05) than neonates delivered by normal vaginal delivery. Neonates born by normal vaginal delivery, however, had more birth trauma and hyperbilirubinemia than neonates born by elective repeated cesarean section (8.8% vs. 2.4%, p<0.001 and 31.8% vs. 22.6%, p<0.05, respectively). There was no difference in the mortality rate between the groups.*
Conclusion: *Even among uncomplicated term pregnancies, cesarean section is associated with more neonatal respiratory morbidity and sepsis while those delivered by normal vaginal delivery tend to have a higher rate of birth trauma and hyperbilirubinemia. Clinicians should therefore be concerned about the route of delivery and the probability of negative neonatal outcomes.*

Keywords: *Repeated cesarean section, Normal delivery, Neonatal mortality, Neonatal morbidities, Uncomplicated term pregnancy*

J Med Assoc Thai 2013; 96 (6): 654-60
Full text. e-Journal: *http://jmat.mat.or.th*

The rate of cesarean section worldwide has dramatically increased to between 30 and 40%[1]. More than 90% of women who have had a previous cesarean section undergo a cesarean section for their next delivery even though there are no other medical indications[2,3]. Thus, one of the most common indications for cesarean section is a previous cesarean. The WHO recommends that the cesarean section rate should be not more than 10 to 15% and that routinely doing it after a previous caesarean should be abandoned. In order to reduce the rate of cesarean section, the WHO encourages vaginal birth after cesarean section (VBAC)[4] especially for uncomplicated or low-risk pregnancies.

The increase of cesarean section rate had been also occurring in most hospitals in Thailand including at Srinagarind Hospital, a university hospital in Northeast Thailand, where the rate of cesareans is currently between 33.6 and 46.6% and for which one of the most common indications is previous cesarean section (26.9-31.6%)[5,6]. Due to personnel and resource insufficiency, vaginal birth after cesarean section is not systematically recommended at Srinagarind Hospital and most other hospitals around Thailand, even for uncomplicated or low-risk pregnancies[7].

The impact of cesarean delivery on neonates is more likely to be associated with increased risk for

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mortality, respiratory morbidities, low Apgar scores, advanced nursery care, and longer hospital stays than normal vaginal delivery, while cesarean delivery is associated with lower rates of stillbirths after 39 weeks of gestation, intrapartum deaths and birth trauma usually associated with normal vaginal delivery[8-14].

Clinicians will be concerned about any negative neonatal outcomes associated with the route of delivery even for uncomplicated term pregnancies. To the authors' knowledge, there has been no evaluation in Thailand of neonatal outcomes with respect to elective repeated cesarean section vs. normal vaginal delivery for uncomplicated term pregnancies. The objective was to determine the morbidities and mortality of neonates born by elective repeated cesarean section vs. normal vaginal delivery for uncomplicated term pregnancies at Srinagarind Hospital.

Material and Method

This was a retrospective descriptive study performed at Srinagarind Hospital, a supra-tertiary center in Northeast Thailand. The population in the present study was neonates at Srinagarind Hospital between January 2009 and December 2011 of uncomplicated term pregnancies delivered by (a) elective repeated cesarean section and (b) normal vaginal deliveries not assisted by forceps or vacuum extraction.

Uncomplicated term pregnancy was defined as singleton, vertex presentation, $37^{0/7}$ to $41^{6/7}$ weeks of gestation, not reporting any medical risk factors or complications of delivery according to the modified US standard certificates of a live birth (1989), such as teenage or elderly pregnancy, grandmultiparity, hypertension, diabetes, cardiac disease, lung disease, renal disease, maternal fever, prolonged rupture of membranes more than 18 hours, antepartum hemorrhage, anesthetic complication and meconium stained amniotic fluid[15]. The neonates were excluded if they (a) were diagnosed with congenital anomalies or chromosome abnormalities and (b) their medical records were incomplete.

The authors collected general demographic data and neonatal outcomes including resuscitation at the delivery room, Apgar scores, advanced nursery ward admission, respiratory supportive care at admission, transient tachypnea of the newborn (TTN), respiratory distress syndrome (RDS), persistent pulmonary hypertension of the newborn (PPHN), pneumonia, minor birth trauma (cephalhematoma, caput succedaneum), major birth trauma (brachial plexus injury, facial palsy, fracture, internal organ hemorrhage), encephalopathy, clinical sepsis, proven sepsis (clinical sepsis with a positive blood culture), hyperbilirubinemia (microbilirubin ≥13 mg/dl), length of hospital stay (LOS) and neonatal mortality.

The χ^2-test was used for categorical variables and the Fisher-exact test for items with $n<5$. Independent sample t-test was used to test mean ± SD between the two groups. P-values <0.05 were considered statistically significant. The present study was approved by the Ethics Committee for Human Research at Khon Kaen University.

Results

During the 3-year study period, 5,965 neonates were delivered at Srinagarind Hospital, 2,405 from uncomplicated term pregnancies by either elective repeated cesarean section or normal vaginal delivery. Of these, 452 neonates were excluded. Of the remaining 1,953 neonates eligible for the present study, 372 were in the elective repeated cesarean section group and 1,581 in the normal vaginal delivery group (Fig. 1).

The neonatal and maternal characteristics are presented in Table 1. The respective average number of times for antenatal care, the average gestational age, and the ratio of males to females was similar between groups. In the repeated cesarean section group, the maternal age was older and the neonatal birth weights higher than in the normal vaginal delivery group, in which there was a higher rate of small for gestational age (SGA). Since the authors studied neonates delivered by repeated cesarean section, all of the neonates in this group were multiparities. By comparison, 53.95% of the neonates in the normal vaginal delivery group were multiparities.

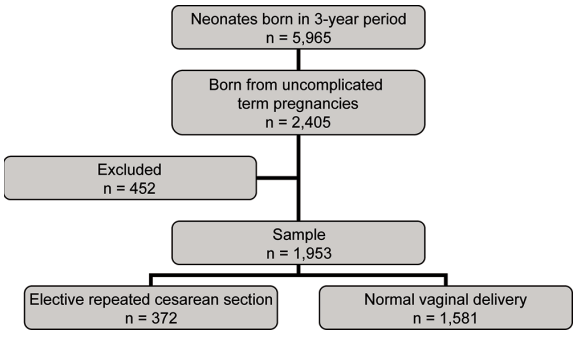

Fig. 1 Number of neonates in each group of the study.

Table 2 compares neonatal outcomes at the delivery room between the normal vaginal delivery group and the elective repeated cesarean section group. A significantly higher rate of O_2 free flow was needed for neonatal resuscitation in the elective repeated cesarean section group than in the normal vaginal delivery group (37.6% vs. 20.9%, p<0.001). None of the neonates needed chest compression, medications, volume expander, or intubation for resuscitation at birth. There was no statistically significant difference found between groups in the Apgar scores either at 1 minute or at 5 minutes.

Table 3 summarizes the neonatal outcomes at admission. The elective repeated cesarean group had a higher rate of needing respiratory support-care including O_2 canular (5.38% vs. 0%, p<0.05), NCPAP (1.1% vs. 0%, p<0.001), mechanical ventilator (0.81% vs. 0%, p<0.001), and surfactant (5.38% vs. 0%, p<0.05). Among neonates born by elective repeated cesarean section the respective rate was also higher than the other group for transient tachypnea of the newborn (3.2% vs. 0.3%, p<0.001), respiratory distress syndrome (0.81% vs. 0%, p<0.001), clinical sepsis (2.4% vs. 0.8%, p<0.05), admission in advanced nursery care included neonatal intensive care unit (NICU) (1.1% vs. 0%, p<0.001) and special care nursery (SCN) (3.8% vs. 1.3%, p<0.001), and length of hospital stay (4.56±2.45 days vs. 4.07±1.44 days, p<0.001). By comparison, the normal vaginal delivery group had higher rates of minor birth traumas (8.79% vs. 2.42%, p<0.001) and hyperbilirubinemia (31.82% vs. 22.58%, p<0.001) than the repeated cesarean section group. None of the neonates in either group had encephalopathy.

Table 1. Description of maternal and neonatal characteristics

Characteristics	Total	Normal vaginal delivery	Repeated cesarean section
Number, n (%)	1,953 (100)	1,581 (100)	372 (100)
Maternal age, years (mean ± SD)	27.71±4.35	27.10±4.31	30.30±3.49
ANC, times (mean ± SD)	9.20±2.46	9.19±2.49	9.23±2.32
Multiparity, n (%)	1,225 (62.72)	853 (53.95)	372 (100)
GA, weeks (mean ± SD)	38.54±1.06	38.67±1.07	38.02±0.86
Male neonate, n (%)	969 (49.60)	789 (49.90)	180 (48.40)
Birth weight, grams (mean ± SD)	3,093.00±365.54	3,075.00±358.54	3,173.00±384.42
SGA, n (%)	45 (2.30)	40 (2.53)	5 (1.34)

ANC = antenatal care; GA = gestational age; SGA = small for gestational age

Table 2. Comparison of neonatal outcomes at birth between those delivered by normal vaginal delivery vs. elective repeated cesarean section

Outcomes at birth	Total, n (%)	Normal vaginal delivery, n (%)	Repeated cesarean section, n (%)	p-value
Neonatal resuscitation				
O_2 free flow	470 (24.10)	330 (20.90)	140 (37.60)	<0.001
PPV	28 (0.90)	14 (0.90)	4 (1.10)	0.762
Chest compression	0 (0)	0 (0)	0 (0)	-
Medications/volume	0 (0)	0 (0)	0 (0)	-
Intubation	0 (0)	0 (0)	0 (0)	-
APGAR at 1 minute				0.922
≤3	4 (0.20)	4 (0.25)	0 (0)	-
4-6	30 (1.54)	24 (1.52)	6 (1.61)	-
≥7	1,919 (98.26)	1,553 (98.23)	366 (98.39)	-
APGAR at 5 minute				-
≤3	0 (0)	0 (0)	0 (0)	-
4-6	0 (0)	0 (0)	0 (0)	-
≥7	1,953 (100)	1,581 (100)	372 (100)	-

PPV = positive pressure ventilation

Table 3. Comparison of outcomes at admission of neonates born by normal vaginal delivery and elective repeated cesarean section

Outcomes at admission	Total, n (%)	Normal vaginal delivery, n (%)	Repeated cesarean section, n (%)	p-value
Respiratory support				
O_2 canular	2 (0.10)	0 (0.00)	2 (5.38)	0.004
NCPAP	4 (0.20)	0 (0.00)	4 (1.10)	<0.001
Mechanical ventilator	3 (0.15)	0 (0.00)	3 (0.81)	<0.001
Surfactant	2 (0.10)	0 (0.00)	2 (5.38)	0.004
Inhale nitric oxide	1 (0.10)	0 (0.00)	1 (0.27)	0.190
Respiratory morbidities				
TTN	16 (0.80)	4 (0.30)	12 (3.20)	<0.001
RDS	3 (0.15)	0 (0.00)	3 (0.81)	<0.001
PPHN	1 (0.10)	0 (0.00)	1 (0.27)	0.190
Pneumonia	0 (0.00)	0 (0.00)	0 (0.00)	-
Birth trauma				
Minor trauma	148 (75.78)	139 (8.79)	9 (2.42)	<0.001
Major trauma	5 (0.26)	5 (0.32)	0 (0.00)	0.278
Infection				
Clinical sepsis	21 (1.10)	12 (0.80)	9 (2.40)	0.005
Proven sepsis	0 (0.00)	0 (0.00)	0 (0.00)	-
CNS morbidities				
Encephalopathy	0 (0.00)	0 (0.00)	0 (0.00)	-
Hyperbilirubinemia	587 (30.06)	503 (31.82)	84 (22.58)	0.001
Ward admission				
NICU	4 (0.20)	0 (0.00)	4 (1.10)	<0.001
SCN	34 (1.70)	20 (1.30)	14 (3.80)	<0.001
LOS, days (mean ± SD)	4.16±1.69	4.07±1.44	4.56±2.45	<0.001[(a)]
Mortality	1 (0.10)	0 (0.00)	1 (0.27)	0.190

(a) Independent sample t-test
NCPAP = nasal continuous positive airway pressure; TTN = transient tachypnea of the newborn; RDS = respiratory distress syndrome; CNS = central nervous system; NICU = neonatal intensive care unit; SCN = special care nursery; LOS = length of stay

Although one neonate delivered by elective repeated cesarean section died from severe persistent pulmonary hypertension of the newborn, there was no significant difference in neonatal mortality between groups.

Since the authors studied neonates delivered by repeated cesarean section, all those in this group were multiparities, while 53.95% of the normal vaginal delivery group were multiparities. The authors stratified the neonatal outcomes of normal vaginal delivery group by parity and the results of any neonatal outcomes not presented in the table were not significantly different between the nulliparity and multiparity groups.

Discussion

The authors examined the morbidities and mortality among neonates delivered by elective repeated cesarean section and normal vaginal delivery after an uncomplicated term pregnancy. As with several other studies[8-10,12,13], neonates delivered by elective repeated cesarean section were more prone to need respiratory support and had a higher rate of respiratory morbidities than neonates delivered by normal vaginal delivery, especially transient tachypnea of the newborn and respiratory distress syndrome. The respective rate of transient tachypnea of the newborn and respiratory distress syndrome in the authors' elective repeated cesarean section group was similar to previous studies[10,12,13].

Cesarean section causes inadequate lung fluid elimination at birth, which results in the neonates having a higher risk for transient tachypnea of the newborn. Even if a neonate is diagnosed with transient tachypnea of the newborn, which is usually accompanied by mild respiratory distress, and it improves within a

few hours: this condition can cause respiratory failure known as malignant transient tachypnea of the newborn[16]. In the present study, the authors encountered a neonate who developed respiratory failure due to malignant transient tachypnea of the newborn.

The American College of Obstetricians and Gynecologists (ACOG) recommends that elective cesarean section should not be performed before 39 weeks of gestation because research has demonstrated an association with increased respiratory morbidities, especially respiratory distress syndrome[17-21]. In the present study, three neonates delivered by elective repeated cesarean section demonstrated respiratory distress syndrome and their respective median gestation age was 37 weeks.

Neonates delivered as repeat cesarean sections had more respiratory morbidities and therefore a higher rate of advanced nursery care and longer length of hospital stay than those delivered through a normal vaginal delivery, consistent with previous studies[10,12].

Based on the authors' findings, elective repeated cesarean section was associated with clinical sepsis because of an increased risk of neonatal infection from: indwelling intravascular lines and endotracheal intubation during advanced nursery ward admission. By contrast, a previous study demonstrated an association between vaginal delivery and neonatal sepsis because of intrapartum complications, including prolonged rupture of membranes, meconium stained amniotic fluid and maternal fever[10].

None of the neonates, in both groups, had any central nervous system morbidities or a low Apgar score at 5 minutes. Perhaps, this is because the authors studied neonates born of uncomplicated term pregnancies, an observation consistent with previous studies[8,10,13] except in one study that showed that neonates born by cesarean section had a higher rate of low Apgar scores at 5 minutes than normal vaginal deliveries. However, the difference between groups in central nervous system morbidities was not statistically significant[12].

A previous study revealed that neonatal mortality increased among neonates delivered by cesarean section vs. vaginal delivery[22]. This does not agree with the authors' findings as the authors could not detect any significant difference in neonatal mortality between groups, perhaps because the sample size - especially the elective repeated cesarean section group - was quite small.

The authors found a higher rate of both minor and major birth trauma in the normal vaginal delivery group despite there not having been any obstetric procedures. By comparison, previous studies reported a significant difference in birth traumas[12,23] associated with vaginal delivery especially assisted by obstetric procedures (i.e., forceps and vacuum extraction). None of the neonates delivered by elective repeated cesarean section had major birth trauma. Owing to the higher rate of minor birth trauma in the normal vaginal delivery group, there was a higher rate of hyperbilirubinemia in these neonates.

The authors suggest studying the long-term neonatal consequences vis-à-vis hospital costs as it may reveal valuable information on both neonatal health management and hospital policies. Moreover, if vaginal birth after cesarean section is performed at Srinagarind Hospital, the maternal and neonatal morbidities should be re-evaluated and discussed with pregnant women and their families about the advantage and disadvantage with respect to neonatal outcomes.

Conclusion

Even in uncomplicated term pregnancies, cesarean section is associated with increasing neonatal respiratory morbidities, clinical sepsis, advanced nursery ward admissions and length of hospital stay. In contrast, neonates born by normal vaginal delivery tend to have a higher rate of minor birth traumas and hyperbilirubinemia. Significant neonatal mortality cannot be identified due to the small number of neonates in the repeated elective cesarean section group.

With respect to the pregnancy issue, clinicians should counsel pregnant women and their respective family about the association between the route of delivery and risk for negative neonatal outcomes even in uncomplicated term pregnancies.

Acknowledgement

The authors wish to thank (a) the hospital records section (b) the patients and their parents/ guardians (c) the physicians and nurses who cared for these patients and their assistance in this study and (d) Mr. Bryan Roderick Hamman and Mrs. Janice Loewen-Hamman for assistance with the English-language presentation of the manuscript.

Funding

The present study was funded by the Faculty of Medicine, Khon Kaen University.

Potential conflicts of interest

None.

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ภาวะแทรกซ้อนและการเสียชีวิตของทารกแรกเกิดจากการผ่าตัดคลอดซ้ำเปรียบเทียบกับการคลอดปกติในมารดาตั้งครรภ์ครบกำหนดความเสี่ยงต่ำในโรงพยาบาลศรีนครินทร์

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วัตถุประสงค์: *เพื่อศึกษาอัตราการเกิดภาวะแทรกซ้อนและการเสียชีวิตของทารกแรกเกิดจากการผ่าตัดคลอดซ้ำเปรียบเทียบกับการคลอดปกติในมารดาตั้งครรภ์ครบกำหนดความเสี่ยงต่ำในโรงพยาบาลศรีนครินทร์*

วัสดุและวิธีการ: *เป็นการศึกษาเชิงพรรณนา โดยเก็บข้อมูลย้อนหลังจากเวชระเบียนผู้ป่วยของทารกที่เกิดโดยการผ่าตัดคลอดที่มีข้อบ่งชี้ คือ มารดาเคยได้รับการผ่าตัดคลอดมาก่อน และทารกที่เกิดโดยการคลอดปกติในมารดาตั้งครรภ์ครบกำหนดความเสี่ยงต่ำในโรงพยาบาลศรีนครินทร์ ตั้งแต่วันที่ 1 มกราคม พ.ศ. 2552 ถึง 31 ธันวาคม พ.ศ. 2554*

ผลการศึกษา: *พบว่าทารกที่เกิดจากมารดาตั้งครรภ์ครบกำหนดความเสี่ยงต่ำในช่วงเวลา 3 ปี ดังกล่าว มีจำนวน 1,953 ราย แบ่งเป็นทารกที่เกิดจากการคลอดปกติ 1,581 ราย และทารกที่เกิดจากการผ่าตัดคลอดซ้ำ 372 ราย ในทารกที่เกิดจากการผ่าตัดคลอดซ้ำต้องได้รับออกซิเจนเมื่อแรกเกิดมากกว่าทารกที่เกิดจากการคลอดปกติ (ร้อยละ 37.6 และร้อยละ 20.9, $p<0.001$) ต้องได้รับการช่วยเหลือด้านการหายใจ โดยได้รับการช่วยหายใจด้วยแรงดันบวก (ร้อยละ 1.1) และใช้เครื่องช่วยหายใจ (ร้อยละ 0.8) มากกว่าทารกที่เกิดจากการคลอดปกติที่ไม่ต้องได้รับการช่วยเหลือด้านการหายใจเลย รวมทั้งทารกที่เกิดจากการผ่าตัดคลอดซ้ำมีภาวะแทรกซ้อนด้านทางเดินหายใจมากกว่าทารกที่เกิดจากการคลอดปกติ โดยเฉพาะอย่างยิ่งภาวะ transient tachypnea of the newborn (ร้อยละ 3.2 และร้อยละ 0.3, $p<0.001$) และภาวะ respiratory distress syndrome (ร้อยละ 0.8 และ ร้อยละ 0, $p<0.001$) นอกจากนี้ยังมีอัตราการติดเชื้อสูงกว่า (ร้อยละ 2.4 และร้อยละ 0.8, $p<0.05$) และมีอัตราการเข้ารับการรักษาในหอผู้ป่วยทารกแรกเกิดระยะวิกฤตมากกว่า (ร้อยละ 1.1 และร้อยละ 0, $p<0.001$) ในกลุ่มที่เกิดจากการคลอดปกติ และทารกที่เกิดจากการผ่าตัดคลอดซ้ำยังมีระยะเวลารักษาในโรงพยาบาลเฉลี่ยมากกว่าอย่างมีนัยสำคัญ (4.56±2.45 วัน และ 4.07±1.44 วัน, $p<0.001$) ในทางตรงข้ามทารกที่เกิดจากการคลอดปกติมีการบาดเจ็บจากการคลอดมากกว่า โดยเฉพาะการบาดเจ็บชนิดไม่รุนแรง (ร้อยละ 8.8 และร้อยละ 2.4, $p<0.001$) และมีภาวะตัวเหลืองมากกว่าทารกที่เกิดจากการผ่าตัดคลอดซ้ำ (ร้อยละ 31.8 และร้อยละ 22.6, $p<0.05$) เมื่อพิจารณาค่าคะแนน APGAR นาทีที่ 1 และนาทีที่ 5 ภาวะแทรกซ้อนด้านระบบประสาท และอัตราการเสียชีวิตพบว่าไม่มีความแตกต่างกันอย่างมีนัยสำคัญในทารกทั้งสองกลุ่ม แม้จะพบทารกในกลุ่มที่เกิดจากการผ่าตัดคลอดซ้ำเสียชีวิต 1 ราย*

สรุป: ทารกที่เกิดจากมารดาตั้งครรภ์ครบกำหนดความเสี่ยงต่ำโดยการผ่าตัดคลอดซ้ำจำเป็นต้องได้รับการช่วยเหลือด้านการหายใจ เกิดภาวะแทรกซ้อนด้านทางเดินหายใจ การติดเชื้อ ได้รับการรักษาในหอผู้ป่วยทารกแรกเกิดระยะวิกฤต รวมทั้งมีระยะรักษาตัวในโรงพยาบาลมากกว่าทารกที่เกิดจากการคลอดปกติ แต่ทารกที่เกิดจากการคลอดปกติมีการบาดเจ็บจากการคลอด และมีภาวะตัวเหลืองมากกว่าทารกที่เกิดจากการผ่าตัดคลอดซ้ำ ส่วนภาวะแทรกซ้อนด้านอื่น ๆ และการเสียชีวิตไม่มีความแตกต่างกัน