Comparison of Maternal Factors and Neonatal Outcomes between Elective Cesarean Section and Spontaneous Vaginal Delivery

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Background: *The rising rate of cesarean section has been of concern worldwide. Maternal factors and neonatal outcomes of cesarean section and vaginal delivery remain unclear.*

Objective: *To compare the differences of maternal factors and neonatal outcomes between mothers who underwent Elective Cesarean Section (ECS) and spontaneous vaginal delivery (SVD)*

Material and Method: *A cross-sectional descriptive research studied all delivery data of Queen Savang Vadhana Memorial Hospital between June 1, 2010 and May 31, 2011. Two thousand eight hundred seventy six deliveries were included. From these, 648 mothers delivered by ECS while 2,228 mothers delivered by SVD. The data quality was tested via the agreement between the 115 sampling delivery records and the same delivery of the extracted data. The percent agreement was 99% (minimum 97-maximum 100). Pearson's Chi-square test and an independent t-test were used to compare the distribution or mean of two groups as appropriate. The statistically significant difference was defined as p-value less than 0.05.*

Results: *The statistically significant differences of maternal factors, and neonatal outcomes between mothers who underwent ECS and SVD were found as follows. The ECS mother showed the mean age (28.7 (3.5) vs. 27.1 (3.8) years, p<0.001), the mean (SD) of number of antenatal care (9.9 (2.8) vs. 7.0 (3.3) times, p<0.001) and the mean (SD) of hematocrit (36.8 (3.3)% vs. 35.8 (3.5)%, p = 0.001) greater than SVD mother.*

The neonates of ECS mother had weight greater than SVD (3,194.5 vs. 3,078.3 grams, p = 0.001), and showed the percentage of presence of respiratory distress syndrome (RDS) higher than the neonate of SVD mother (5.5% vs. 0.4%, p = 0.010). The neonates of SVD mother had mean Apgar scores at first minute (8.0 vs. 7.9 scores, p = 0.015) and at fifth minute (9.8 vs. 9.5 scores, p = 0.001) greater than the neonates of ECS mother. They demonstrated the percentages of presence of meconium stain in amniotic fluid (MSAF) and presence of cord accident higher than neonate of CS mother (5.3% vs. 2.5%, p = 0.002, and 16.9% vs. 2.5%, p = 0.001, respectively).

Conclusion: *The neonates of ECS mother had a greater weight and a higher risk for pulmonary problems. The neonates of SVD mother have a higher risk for MSAF, cord accident, and meconium aspiration. It reflected the need for prolong process of labor and delivery prevention.*

Keywords: *Elective Cesarean section (ECS), Spontaneous vaginal delivery (SVD), Maternal factors, Neonatal outcomes*

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The rising rate of cesarean section (CS) in Thailand has been of concern[1] due to the several factors including the increased perception of safety[2] and the rising of elective cesarean section (ECS)[3,4]. However, the several studies indicated that CS had more negative effects on the mothers than SVD[4-7] such as a five-fold risk for hysterectomy (4.6 (95% CI 2.8-7.4)), a three-fold risk of death (3.4 (95% CI 1.1-10.65))[6], a five-fold risk of wound hematoma (5.1 (95% CI 4.6-5.5)[5], and a higher rate of thromboembolic (0.39% vs. 0.07%)[8]. In addition, mothers that underwent intrapartum CS with indications had increase maternal mortality and morbidity index 14.5-fold (95% CI 13.2-16.0) when compared with SVD[9]. In contrast, only one study reported that SVD had more negative effects on the mothers than CS such as more obstetrical trauma rate (4.88% vs. 0.46%) and postpartum hemorrhage rate (2.79% vs. 1.35%)[8].

It is questionable whether the increased CS rate has had any significant influence on the maternal

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or neonatal benefits[4]. Besides, studies on maternal and child outcome, morbidity, and complications from CS, risks, and benefits are needed to serve as a solid foundation for consensus development among all parties concerned[3]. Therefore, the present study aimed to compare differences of maternal factors, and neonatal outcomes between mothers who underwent ECS and SVD.

Material and Method

This research project received ethics approval from the ethic committee of Queen Savang Vadhana Memorial Hospital.

A cross-sectional descriptive research was conducted. All delivery data of the hospital information system (HIS) of Queen Savang Vadhana Memorial Hospital between June 1, 2010 and May 31, 2011 were extracted. The terms "elective cesarean section", and "spontaneous vaginal delivery" were defined as the terms those had been recorded in the HIS.

The exclusion criteria were abortion, previous cesarean section, and gestation less than or equal to 28 weeks. The inclusion criteria were mothers who were 21 to 34 years old and delivered by ECS or SVD. Two thousand eight hundred seventy six deliveries were included in this study of which, 648 mothers delivered by ECS while 2,228 mothers delivered by SVD. The data quality was tested via the agreement between the 115 sampling delivery records and the same delivery of the extracted data. The percent agreement was 99% (minimum 97-maximum 100).

The parameters were collected in both interval and ordinal scale. The maternal factors included age, primigravida, number of antenatal care, and hematocrit at admission. The neonatal outcomes comprised of gestational age, birth weight, meal gender, alive, Apgar scores at first and fifth minute, presences of meconium stain in amniotic fluid (MSAF), secretion in airway, resuscitate after birth, trauma lesions, cord accident, hospitalized, death after hospitalized, and causes of hospitalized. The causes of hospitalized involved newborn affected by maternal factors, light/small for gestational age, extremely low birth weight, low birth weight, severe birth asphyxia, respiratory distress syndrome (RDS), and meconium aspiration. The definitions of diagnoses based on the International Classification of Diseases and Related Health Problem Tenth Revision (ICD-10)[10].

SPSS for Windows version 13.0 was used for data analysis. The distribution of data was tested by the Kolmogorov-Smirnov test (K-S test). Qualitative data was presented in frequency and percentage. Quantitative data were presented in mean with standard deviation (SD) in normal distribution data. Pearson's Chi-square test or Fisher's exact test was used to compare the distribution of categorical variables of two groups. An independent t-test was used to compare mean of two groups. The statistically significant difference was defined as p-value less than 0.05.

Results

The results comprised of two parts, comparison of maternal factors and neonatal outcomes between ECS and SVD with an independent t-test, and with a Chi-square test as shown in Table 1, and Table 2 below.

The ECS mother showed the mean (SD) age (28.7 (3.5) vs. 27.1 (3.8) years, $p<0.001$), the mean (SD) of number of antenatal care (9.9 (2.8) vs. 7.0 (3.3) times, $p<0.001$), and the mean (SD) of hematocrit at admission (36.8 (3.3)% vs. 35.8 (3.5)%, $p<0.001$) greater than SVD mother with statistically significant differences as shown in Table 1.

Table 1. Comparison of maternal factors and neonatal outcomes between ECS and SVD with an independent t-test

Maternal factorsand neonatal outcomes	Mean (SD)		t	p-value
	ECS (n = 648)	SVD (n = 2,228)		
Maternal factors				
Age (years)	28.7 (3.5)	27.1 (3.8)	9.5	<0.001*
Number of antenatal care (times)	9.9 (2.8)	7.0 (3.3)	19.8	<0.001*
Hematocrit (%)	36.8 (3.3)	35.8 (3.5)	6.2	<0.001*
Neonatal outcomes				
Gestational age (weeks)	38.4 (1.2)	38.3 (1.6)	1.9	0.050
Birth weight (grams)	3,194.5 (461.7)	3,078.3 (423.4)	6.0	<0.001*
Apgar scores at 1st minute (scores)	7.9 (0.6)	8.0 (0.6)	2.4	0.015*
Apgar scores at 5th minute (scores)	9.5 (0.5)	9.8 (0.4)	14.7	<0.001*

* p-value less than 0.05

The mean (SD) of neonatal gestational age between ECS and SVD was not different (38.4 (1.2) vs. 38.3 (1.6) weeks, p = 0.050). The neonates of ECS mother had the mean (SD) of birth weight greater than SVD with statistically significant differences (3,194.5 (461.7) vs. 3,078.3 (423.4) grams, p<0.001). The neonates of SVD presented the mean (SD) of Apgar scores at first minute (8.0 (0.6) vs. 7.9 (0.6) scores, p = 0.015) and at fifth minute (9.8 (0.4) vs. 9.5 (0.5) scores, p<0.001) greater than ECS with statistically significant differences as shown in Table 2.

The neonate of SVD mothers had the percentages of presence of MSAF (5.3% vs. 2.5%, p = 0.002) and presence of cord accident (16.9% vs. 2.5%, p<0.001) more than CS with statistically significant differences. Whereas the neonate of CS mothers had the percentage of presence of RDS more than SVD with statistically significant differences (5.5% vs. 0.4%, p = 0.010) as shown in Table 2.

Discussion

The results demonstrated that mothers who underwent ECS were older than SVD, which is similar to the previous studies[7,11-13]. The prospective survey of 18,653 singleton deliveries in Norway found that maternal age of ECS was older than SVD with statistically significant difference (31.4 (SD 4.9) vs. 28.8 (SD 4.9), p<0.001)[11]. In America, nearly half (47.6%) of birth among women ages 40 and over were delivered by CS[7]. Recently, the systematic review study has shown that all studies demonstrated women at advanced maternal age had an increases risk of CS compared with younger women (relative risk varied from 1.39 to 2.76)[12,13]. In addition, in Thailand, the survey study indicated that mothers older than 36 years old had odd ratio for CS at 1.41[3]. Although the average age of mothers included ECS and SVD in the present study seem to be younger than in the other studies, the result confirmed that mothers who underwent ECS were older than SVD.

The neonates of ECS mother had birth weight greater than those of SVD mothers. Unlike the previous studies[11,14-16], for instance, the study in Norway found that mean birth weight of planned vaginal group was greater than planned cesarean group (3,648 (SD 504.5) and 3,561 (SD 533.3) grams, respectively)[11]. However, the mean birth weight at delivery of CS and SVD in Canada[14] and in Iran[15] were comparable (in Canada 3,563 (SD 426) and 3,545 (SD 390) grams (p = 0.22))[14], in Iran 3,130.3 (SD 432.1) and 3,145.1

Table 2. Comparison of neonatal outcomes between ECS and SVD with a Chi square test

Neonatal outcomes	Number (%)		χ^2	p-value
	ECS (n = 648)	SVD (n = 2,228)		
Male	347 (53.5)	1,120 (50.3)	2.2	0.153
Alive	648 (100.0)	2,220 (99.6)	2.3	0.212
Meconium stain in amniotic fluid (MSAF)	16 (2.5)	118 (5.3)	9.0	0.002*
Secretion in airway	2 (0.3)	2 (0.1)	1.7	0.221
Resuscitate after birth	1 (0.2)	1 (0.0)	0.9	0.400
Trauma lesions	3 (0.5)	6 (0.3)	0.6	0.430
Cord accident	16 (2.5)	377 (16.9)	88.9	<0.001*
Hospitalized	72 (11.1)	254 (11.4)	0.0	0.888
Death after hospitalized	2 (2.7)	5 (2.0)	0.2	0.655
Cause of hospitalized				
Newborn affected by maternal factors and by complications of pregnancy, labor, and delivery	1 (1.4)	5 (2.0)	0.1	1.000
Light/small for gestational age	0 (0.0)	2 (0.8)	0.6	1.000
Extremely low birth weight	0 (0.0)	1 (0.4)	0.3	1.000
Low birth weight	15 (20.5)	47 (18.6)	0.1	0.736
Severe birth asphyxia	0 (0.0)	2 (0.8)	0.6	1.000
Respiratory distress syndrome	4 (5.5)	1 (0.4)	9.7	0.010*
Meconium aspiration	0 (0.0)	5 (2.0)	1.5	0.591

* p-value less than 0.05

(450.9) grams[15]). It was observed that the greater neonatal birth weight of ECS mother in the present study may relate to the indication for CS.

The neonates of ECS mother had presence of RDS with the Apgar score less than those of SVD mother. These results were consistent with previous studies[11,16]. Zanardo et al[16] demonstrated that RDS was significantly higher in the infant group delivered by ECS compared with vaginal delivery (OR 2.6; 95% CI: 1.35-5.9; p<0.01). Kolås et al[11] (2006) expressed that a planned cesarean delivery doubled the risk for RDS from 0.8% to 1.6% (p = 0.01) when compared with planned vaginal deliveries. Indeed, the infants who are born by cesarean delivery without preceding spontaneous uterine contractions lack the thoracic compression effect, which is essential for normal respiration adaptation[11]. Consequently, these babies required higher rates of oxygen supplementation and ventilator support in the NICU[17]. Therefore, the present study verified that neonates of ECS mother had a greater weight than SVD thus, should be done ECS. However, these neonates have a risk for pulmonary problems that will need respiratory care.

However, SVD presented some effects to neonates from the process of labor and delivery. The neonates of SVD showed higher percentages of presence of MSAF along with presence of cord accident and meconium aspiration than CS mothers. These effects may relate to placental insufficiency in SVD mother, cord compression that may cause peristalsis, and relaxation of the rectal sphincter leading to meconium passage[18]. In addition, the previous study indicated that the risk factors for MSAF were fetal distress, and cord problems[19]. The severity of MSAF associated with meconium aspiration syndrome[20]. Conversely, the recent study found that overall risk of adverse outcomes in MSAF is low[21]. In conclusion, SVD is needed for prevention of prolonged process of labor and delivery.

The present study has some limitations. First, we defined ECS as the term that had been recorded in the information system with unknown indication. Second, this study lacks maternal complications perspective. However, this study had several strengths. First, it is an observational survey that compared outcomes between ECS and SVD in the same setting. Second, previous cesarean section was excluded to avoid bias. Third, the study used available data of delivery records of HIS to maximize the benefits of information.

Conclusion

The results revealed that ECS had been done in neonates with greater weight. However, these neonates had presence of RDS with less Apgar score than those of SVD mothers, which risked pulmonary problems and needed for respiratory care. On the contrary, the neonates of SVD mother had the higher percentages of presence of MSAF and presence of cord accident than CS. That reflected the need for prolonged process of labor and delivery prevention. Further studies of maternal complications between these procedures are required.

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Potential conflicts of interest

None.

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การเปรียบเทียบปัจจัยด้านมารดาและผลลัพธ์ของทารกระหว่างมารดาที่คลอดด้วยวิธีการเลือกผ่าตัดกับมารดาที่มีการคลอดเองทางช่องคลอด

ชื่นฤทัย ยี่เขียน, สมศักดิ์ เจษฎาพรชัย, คงศักดิ์ อุไรรงค์, สมรักษ์ สันติเบญจกุล, วันเพ็ญ สุขส่ง, ชัยเวช นุชประยูร

ภูมิหลัง: ทั่วโลกให้ความสำคัญกับอัตราการผ่าตัดคลอดที่เพิ่มขึ้น อย่างไรก็ตาม ปัจจัยด้านมารดาและผลลัพธ์ของทารกระหว่างมารดาที่คลอดด้วยวิธีการผ่าตัดกับมารดาที่มีการคลอดทางช่องคลอดยังไม่ชัดเจน

วัตถุประสงค์: เพื่อเปรียบเทียบปัจจัยด้านมารดาและผลลัพธ์ของทารกระหว่างมารดาที่คลอดด้วยวิธีการเลือกผ่าตัดกับมารดาที่มีการคลอดเองทางช่องคลอด

วัสดุและวิธีการ: ผู้นิพนธ์รวบรวมข้อมูลการคลอดที่บันทึกไว้ในระบบเทคโนโลยีสารสนเทศโรงพยาบาลตั้งแต่วันที่ 1 มิถุนายน พ.ศ. 2553 ถึง วันที่ 31 พฤษภาคม พ.ศ. 2554 ซึ่งมีการคลอดทั้งหมด 2,876 ราย เป็นมารดาที่คลอดด้วยวิธีการเลือกผ่าตัด 648 ราย และเป็นมารดาที่มีการคลอดเองทางช่องคลอด 2,228 ราย ทำการตรวจสอบคุณภาพข้อมูล โดยการสุ่มบันทึกการคลอดจำนวน 115 ฉบับ นำมาตรวจสอบความตรงกันกับข้อมูลที่บันทึกไว้ในระบบเทคโนโลยีสารสนเทศโรงพยาบาลรายเดียวกันพบว่ามี percent agreement คิดเป็น 99% (ค่าต่ำสุด 97-ค่าสูงสุด 100) สถิติที่ใช้เปรียบเทียบเป็นค่าสถิติไคสแคว์หรือ Fisher's exact test และสถิติที่กำหนดค่าความมีนัยสำคัญทางสถิติที่ค่า p น้อยกว่า 0.05

ผลการศึกษา: ปัจจัยด้านมารดาและผลลัพธ์ของทารกระหว่างมารดาที่คลอดด้วยวิธีการเลือกผ่าตัดกับมารดาที่มีการคลอดเองทางช่องคลอดที่แตกต่างกันอย่างมีนัยสำคัญทางสถิติ มีดังนี้ มารดาที่คลอดด้วยวิธีการเลือกผ่าตัดมีอายุเฉลี่ย (ค่าเบี่ยงเบนมาตรฐาน) (28.7 (35.5) vs. 27.1 (3.8) ปี, p<0.001), จำนวนครั้งการมาตรวจครรภ์เฉลี่ย (ค่าเบี่ยงเบน มาตรฐาน) (9.9 (2.8) vs. 7.0 (3.3) ครั้ง, p<0.001), ฮีมาโตคริตเมื่อแรกรับเฉลี่ย (ค่าเบี่ยงเบนมาตรฐาน) (36.8 (3.3) vs. 35.8 (3.5)%, p<0.001) มากกว่ามารดาที่มีการคลอดเองทางช่องคลอด ทารกที่คลอดจากมารดาที่มีการคลอดเองทางช่องคลอดมีค่าเฉลี่ย (ค่าเบี่ยงเบนมาตรฐาน) ของ Apgar scores นาทีที่ 1 (8.0 (0.6) vs. 7.9 (0.6) คะแนน, p = 0.015) และนาทีที่ 5 (9.8 (0.4) vs. 9.5 (0.5) คะแนน, p<0.001) มากกว่าทารกที่คลอดจากมารดาที่คลอดด้วยวิธีการเลือกผ่าตัด ทารกที่คลอดจากมารดาที่คลอดด้วยวิธีการเลือกผ่าตัดมีร้อยละการเกิด respiratory distress syndrome (5.5% vs. 0.4%, p = 0.010) มากกว่าทารกที่คลอดจากมารดาที่มีการคลอดเองทางช่องคลอด ทารกที่คลอดจากมารดาที่มีการคลอดเองทางช่องคลอดมีร้อยละการเกิด MSAF และ cord accident มากกว่าทารกที่คลอดจากมารดาที่คลอดด้วยวิธีการเลือกผ่าตัด (5.3% vs. 2.5%, p = 0.002, and 16.9% vs. 2.5%, p<0.001, ตามลำดับ)

สรุป: ทารกที่คลอดจากมารดาที่เลือกผ่าตัดคลอดมีน้ำหนักมากกว่าแต่มีความเสี่ยงต่อการเกิดปัญหา ที่ระบบทางเดินหายใจ ทารกที่คลอดจากมารดาที่คลอดเองทางช่องคลอดมีความเสี่ยงต่อการเกิด MSAF และ cord accident ซึ่งควรจะป้องกันการมีกระบวนการคลอดที่ยาวนาน