Thai Journal of Obstetrics and Gynaecology
October 2016, Vol. 24, pp. 265-272

OBSTETRICS

Maternal and Neonatal Outcomes of Repeated Cesarean Delivery: A Comparison between Transverse and Vertical Skin Incision

Anutsara Promket, M.D.*,
Suphet Tuipae, M.D.*,**.

** Department of Obstetrics and Gynecology, Rajavithi Hospital, Bangkok 10400, Thailand*
*** College of Medicine, Rangsit University, Bangkok 12120, Thailand*

ABSTRACT

Objectives: To compare maternal and neonatal outcomes in women who had repeated cesarean section between transverse and vertical skin incision.

Materials and Methods: This comparative study was conducted from April 2014 until July 2015 at Rajavithi Hospital. Patients were recruited from women who had planned and undergone repeated cesarean delivery both scheduled and in emergency conditions. Women who enrolled in this study were having single pregnancy, without classical cesarean section, previous intra-abdominal surgery from other indication, and HIV infection backgrounds. Subjects were divided into two groups, transverse and vertical skin incisions. Data was collected from antenatal care records, anesthetic notes, operative notes and the research record forms.

Results: According to the inclusion and exclusion criteria, 500 subjects were selected. There were 286 and 214 subjects in the transverse and vertical skin incision groups, respectively. Incision-to-delivery interval in transverse was longer than in the vertical group by about 2 minutes ($p < 0.001$). The total operative time ± SD was 84.67±30.96 and 79.69±26.83 minutes in the transverse and vertical skin incision groups, respectively ($p = 0.043$). There was no statistical difference in internal organ injuries, estimated blood loss, post-operative outcomes, Apgar scores and fetal injuries.

Conclusion: In repeated cesarean delivery, transverse skin incision illustrated more incision-to-delivery interval and total operative time than vertical skin incision, but no difference in adverse maternal and neonatal outcomes.

Keywords: repeated cesarean section, transverse skin incision, vertical skin incision, incision-to-delivery interval, total operative time

Correspondence to: *Anutsara Promket, M.D., Department of Obstetrics and Gynecology, Rajavithi Hospital, Bangkok 10400, Thailand, Phone: 02-354-8106 ext 3226, Email: Anut_dle@hotmail.com*

ผลลัพธ์ในมารดาและทารกแรกเกิดจากการผ่าท้องทำคลอดซ้ำ: เปรียบเทียบระหว่างการลงมีดผ่าตัดหน้าท้องแนวขวางและแนวตั้ง

อนุสสรา พรมเกตุ, สุเพ็ชร ทุ้ยแป

บทคัดย่อ

วัตถุประสงค์: *เพื่อศึกษาเปรียบเทียบผลลัพธ์ที่เกิดขึ้นในมารดาและทารก (ระหว่างผ่าตัดและภายหลังการผ่าตัด) ที่ได้รับการผ่าท้องทำคลอดระหว่างการลงมีดแผลแนวขวางและแนวตั้ง*

วัสดุและวิธีการ: *การศึกษานี้เป็นการศึกษาแบบไปข้างหน้า (prospective comparative study) จัดทำการเก็บข้อมูลตั้งแต่เมษายน 2557 ถึง กรกฎาคม 2558 เกณฑ์การคัดผู้ป่วยเข้าในโครงการวิจัย ต้องเป็นสตรีตั้งครรภ์เดี่ยว และมีประวัติผ่าตัดคลอดแนวขวางหรือแนวตั้งมาก่อน โดยทำการเก็บข้อมูลทั้งสตรีที่ได้รับการผ่าตัดแบบเร่งด่วนและไม่เร่งด่วน โดยมีเกณฑ์คัดออกคือ เคยมีประวัติผ่าตัดในช่องท้องจากสาเหตุอื่นนอกเหนือจากการผ่าท้องทำคลอด, เคยผ่าตัดบริเวณมดลูกแบบ classical cesarean section, ขณะตั้งครรภ์นี้มีการติดเชื้อ HIV, ทารกในครรภ์มีความพิการถึงแก่ชีวิต และภาวะฉุกเฉินอย่างเช่น fetal distress หรือสายสะดือย้อย*

ผลการศึกษาวิจัย: *จากเกณฑ์การคัดผู้ป่วยเข้าและออกจากโครงการวิจัย ทำให้ได้ผู้เข้าร่วมวิจัยทั้งหมดจำนวน 500 คน โดยแบ่งเป็นกลุ่มที่มีแผลผ่าตัดหน้าท้องแนวขวางมาก่อน 286 ราย และแผลผ่าตัดแนวตั้ง 214 ราย พบว่าระยะเวลาตั้งแต่ลงมีดผ่าตัดจนกระทั่งทารกคลอดในกลุ่มแผลผ่าตัดแนวขวางใช้เวลามากกว่ากลุ่มแผลผ่าตัดแนวตั้งประมาณ 2 นาที ระยะเวลาที่ใช้ในการผ่าท้องทำคลอดทั้งหมดในกลุ่มแผลผ่าตัดหน้าท้องแนวขวางและแนวตั้ง มีค่าเฉลี่ยคือ 84.67 ± 30.96 นาที และ 79.69 ± 26.83 นาที ตามลำดับ (p=0.043) ในการศึกษานี้ ไม่พบความแตกต่างกันอย่างมีนัยสำคัญทางสถิติในเรื่องของการบาดเจ็บต่ออวัยวะอื่นในช่องท้อง, ปริมาณเลือดที่สูญเสียระหว่างผ่าตัด, ผลกระทบในมารดาหลังการผ่าตัด, Apgar scores และการบาดเจ็บของทารก*

สรุป: *การผ่าท้องทำคลอดซ้ำกลุ่มที่มีแผลผ่าตัดหน้าท้องแนวขวาง ใช้ระยะเวลาตั้งแต่ลงมีดผ่าตัดจนกระทั่งทารกคลอด และระยะเวลาที่ใช้ในการผ่าท้องทำคลอดทั้งหมดนานมากกว่ากลุ่มที่มีแผลผ่าตัดแนวตั้ง แต่ไม่ได้เกิดผลลัพธ์ที่ไม่ดีในมารดาและทารกอย่างมีนัยสำคัญทางสถิติ*

Introduction

Cesarean delivery is an operation performed for delivery of the fetus from abdominal and uterine walls in the period of which the fetus is able to survive[1]. The World Health Organization (WHO) recommends that the appropriate proportion of cesarean delivery should not be over 15 percent of overall labor[2]. In Thailand, there is a report which shows the cesarean delivery rate at 22.4 percent in 1996. But one third (35.9%) of operations are repeated cesarean delivery[3]. In Rajavithi Hospital, there has been a significant rise of the cesarean delivery ratio from 25.5 percent in 2002 to 34.7 percent in 2011[4]. Increase of cesarean deliveries would result in an increase repeated operation rate. Consequently, a previous study found that a repeated operation provides an increase risk of complications related to procedures such as intra-operative blood loss, hysterectomy after cesarean delivery, endometritis, intra-abdominal adhesions, wound infections and wound disruption including other organ injuries (urinary bladder and bowel)[5,6].

There are two types of skin incisions for cesarean delivery, vertical and transverse incision. The decision of the surgeon for skin incision is considered according to the surgical difficulty, operative area, surgeon expertise, previous abdominal scar, feasibility of wound extension, wound infections and cosmetic outcomes[1,7]. Vertical or midline incision can be performed in a short operative time and has a feasibility of surgical extension. Transverse skin incision reveals more advantages than vertical incision in the aspect of less intra-operative blood loss, post-operative pain and better cosmetic outcomes. The common transverse incision type is Pfannenstiel incision which incises along natural skin creases. It is usually done in uncomplicated cases. In contrast, repeated cesarean delivery in both types of skin incision can lead to desperate complications[7]. Previous reports show the incidence of intra-abdominal injury of repeated higher than primary cesarean delivery[8]. Repeat cesarean associated with bladder injury in 0.81 percent cases in compared to primary cesarean 0.27 percent[9]. Surprisingly, one study found repeated cesarean delivery with midline incision was associated with higher risk of bladder and bowel injury[10].

The study aims to identify the difference of maternal and neonatal outcomes focusing on different skin incisions in repeated cesarean delivery.

Materials and Methods

This prospective comparative study was conducted after approval from the Research Ethical Committees of Rajavithi Hospital. The study was performed between April 2014 and July 2015. Patients who plan for repeating a cesarean delivery were categorized in to 2 groups, prior transverse and vertical incision. The inclusion criteria are single pregnancy with previous cesarean delivery in both scheduled and emergency cases. The exclusion criteria are previous classic cesarean delivery, previous intra-abdominal surgery from other indication, HIV infection, lethal fetal anomaly and other emergency conditions, such as fetal distress and prolapsed cord. There are four parts of data record; maternal demographic data, intra-operative data, post-operative data and fetal outcomes (Apgar score at 1st and 5th minute, fetal injuries). The data is recorded in the research record forms.

The collected data was implemented with processes to identify the comparative outcomes. According to the calculation, the study subject of five hundred was required to participate in statistical assessment.

All statistical information could be analyzed with the SPSS program version 17.0 concentrating on means, standard deviation (SD) to specify the driver of adverse outcomes for transverse and vertical incisions. Student T-test would be used for an analysis of quantitative comparison and Mann-Whitney U test could be applied for abnormal distribution data. As regards qualitative data, Chi-square and Fisher test where p-value was lower than 0.05 were implemented after conducting unvaried analysis. Then, the analysis continued with the application of logistic regression statistic.

Results

The total subjects were 500 pregnant women, grouped into transverse (286) and vertical incision (214), respectively. Baseline characteristics are shown in Table 1. There were no differences in gestational age, the number of pregnancies and number of previous cesarean delivery, medical and obstetrical complications. Nevertheless, most women who had previous cesarean delivery in transverse incision derived from elective cases compared with vertical incision (63.6 and 50.9 percent; p = 0.004). The study found that the subject of transverse incision received more spinal block for anesthesia than vertical incision (52.8 and 39.3 percent; p = 0.003). Patients in the transverse skin incision group had more assisted delivery of fetus with forceps extraction than the vertical group, 47.6 percent and 24.8 percent, respectively (p < 0.001).

Table 1. Baseline characteristics.

Characteristics	Prior skin incision				p value
	Transverse (n = 286)		Vertical (n = 214)		
Age (years)	31.72 ± 5.53		30.51 ± 5.66		0.017*
Etiology	37.62 ± 1.78		37.51 ± 1.75		0.493*
No. of Pregnancy					0.172†
2	191	(66.8%)	126	(58.9%)	
3	65	(22.7%)	63	(29.4%)	
≥ 4	30	(10.5%)	25	(11.7%)	
No. prior cesarean section					0.459†
1	256	(89.5%)	187	(87.4%)	
≥ 2	30	(10.5%)	27	(12.6%)	
Type of operation					0.004†
Elective	182	(63.6%)	109	(50.9%)	
Emergency	104	(36.4%)	105	(49.1%)	
Medical complication	26	(9.1%)	21	(9.8%)	0.784†
Obstetric complication	111	(38.8%)	88	(41.1%)	0.602†
Anesthetic type					0.003†
Spinal block	151	(52.8%)	84	(39.3%)	
General anesthesia	135	(47.2%)	134	(60.7%)	
Level of operator					< 0.001†
Resident	141	(49.3%)	187	(87.4%)	
Staff	145	(50.7%)	27	(12.6%)	
Forceps extraction	136	(47.6%)	53	(24.8%)	< 0.001†
Adhesions					0.111
Dense	27	(9.4%)	30	(14.0%)	
Filmy and Absent	259	(90.6%)	184	(86.0%)	

Data are mean ± standard deviation or n (%)

* Independent t-test, † Chi-Square test

Table 2 demonstrates maternal outcomes. In this study, incision-to-delivery interval means time from initial skin incision to complete delivery of the infant (minute). Both incision-to-delivery interval and total operative time in this table are shown in mean±S.D. However, transverse incision consumed more time in delivery than vertical incision, 10.58±4.93 and 8.59±4.11 minutes, respectively ($p < 0.001$). Furthermore, the former consumed more total operative time than the vertical incision group, 84.67±30.96 and 79.69±26.83 minutes, respectively ($p = 0.043$).

Regarding to estimated blood loss, intra-operative blood transfusion, post-operative blood transfusion, internal organ injury, tearing of lower uterine segment, hysterectomy after cesarean section and uterine embracement procedure were not different between both groups. Tearing of lower uterine segment was found in four cases, three in transverse incision and one in vertical incision. All of the tearing of lower uterine segment needed only suture, approximately 2-3 stitches, and no other complications.

Post-operative outcomes including length of hospital stay, post-operative pain, puerperal infection, delayed post-partum hemorrhage, surgical wound infection and re-operation were not different. Both groups had no surgical wound infection and re-operation. One woman from transverse incision had urinary tract infection, which received oral antibiotics. Endometritis was detected in one woman from vertical incision, which required intravenous antibiotic treatment and no other complications.

Table 2. Maternal outcomes.

Maternal outcomes	**Prior skin incision**				**P**
	Transverse (n = 286)		**Vertical (n = 214)**		
Incision-to-delivery interval (min)	10.58 ± 4.93		8.59 ± 4.11		< 0.001*
Total operative time (min)	84.67 ± 30.96		79.69 ± 26.83		0.043*
Estimated blood loss (ml)	425.85 ± 211.53		459.39 ± 240.39		0.173*
Length of stay (day)	3.78 ± 1.19		3.84 ± 1.04		0.595†
Post-operative pain					
Pain Score 6 hr	3.96 ± 1.70		4.09 ± 1.86		0.492†
Pain Score 12 hr	3.77 ± 1.40		3.92 ± 1.60		0.310†
Pain Score 24 hr	3.45 ± 1.45		3.37 ± 1.43		0.581†
Intraoperative blood transfusion	1	(0.3%)	2	(0.9%)	0.579‡
Post-operative blood transfusion	2	(0.7%)	3	(1.4%)	0.656‡
Organ injury	0	(0%)	0	(0%)	
Tearing of lower uterine segment	3	(1.0%)	1	(0.5%)	0.639‡
Puerperal infection	24	(8.4%)	27	(12.6%)	0.122§
Febrile morbidity	23	(8.0%)	26	(12.1%)	
Urinary tract infection	1	(0.4%)	0	(0%)	
Endometritis	0	(0%)	1	(0.5%)	
Delayed post-partum hemorrhage	1	(0.3%)	0	(0%)	1.000‡

Data are mean ± standard deviation or n (%)

*Mann-Whitney U test, † Independent t-test, ‡ Fisher's Exact Test, § Chi-Square test

Neonatal outcomes are shown in Table 3. There were no statistical difference in Apgar scores at the 1st and 5th minute and fetal injury between both groups. When we focused on the association of maternal outcomes and intra-abdominal adhesion (Table 4), transverse skin incision with dense adhesion consumed incision-to-delivery interval and total operative time more than vertical (transverse: 14.77±5.48 minutes and vertical: 10.66±5.76 minutes, p = 0.007 for incision-to-delivery interval). As regards total operative time, it could be seen that transverse and vertical incision were 105.27±27.98 minutes and 90.55±33.39 minutes, p=0.045.

Table 3. Neonatal outcomes.

Neonatal outcomes	Prior skin incision				p value
	Transverse (n = 286)		Vertical (n = 214)		
	n	(%)	n	(%)	
Apgar Score at 1 min					0.994*
< 7	12	(4.2%)	9	(4.2%)	
≥ 7	273	(95.8%)	204	(95.8%)	
Apgar Score at 5 min					0.579†
< 7	1	(0.4%)	2	(0.9%)	
≥ 7	284	(99.6%)	211	(99.1%)	
Fetal injury					0.852†
Abrasion	4	(1.4%)	2	(0.9%)	
Forceps mark	14	(4.9%)	9	(4.2%)	

* Chi-Square test, † Fisher's Exact

Table 4. Maternal outcomes associated with intra-abdominal adhesion according to skin incision.

Outcomes	Prior skin incision		p value
	Transverse	Vertical	
	Mean±S.D.	Mean±S.D.	
Incision-to-delivery interval (min)			
Dense	14.77±5.48	10.60±5.76	0.007*
Filmy and Absent	10.16±4.68	8.26±3.69	<0.001*
Total operative time (min)			
Dense	105.27±27.98	90.50±33.39	0.045*
Filmy and Absent	82.58±30.53	77.92±25.27	0.091*

* Mann-Whitney U test

After adjusting for age, type of operation, anesthetic type, level of operator and assistance of delivery by using analysis of covariance, both incision-to-delivery interval and total operative time were longer with transverse skin incision (Table 5).

Table 5. Multivariate analysis.
Factors associated with cesarean delivery between transverse and vertical skin incision (n=500).

Time	Crude	95%CI	p value	Adj. OR	95%CI	p value
Incision-to-delivery interval (min)	1.106	1.059-1.156	< 0.001	1.162*	1.103-1.225	< 0.001
Total operative time (min)	1.006	1.000-1.013	0.064	1.010*	1.002-1.018	0.017

* Chi-Square test, † Fisher's Exact

Discussion

The present study demonstrates maternal and neonatal outcomes comparing between transverse and vertical skin incision of repeated cesarean section. In case of maternal outcomes, incision-to-delivery interval and total operative time in the transverse skin incision group were more than the vertical skin incision group by 2 minutes (p<0.001) and 5 minutes (p=0.043), respectively. In contrast, there was no statistical different in Apgar scores at the 1st and 5th minute between both groups. Wylie et al[7] found that in emergency cesarean deliveries, neonatal delivery occurred more quickly after a vertical skin incision, but this did not improve neonatal outcomes. Prior knowledge supports that vertical skin incision has fast access into the abdominal cavity and has feasibility for wound extension. Hence, it can reduce time for delivery. The advantage of transverse skin incision is that it can reduce risk of incisional hernia and also improve cosmetic and hypertrophic scar outcome. Total operative time with transverse skin incision would vary according to surgeon expertise. Generally, the surgeon who is over concerned in skin closure would consume extra attention causing a dramatic increase of aggregate operative times.

The researchers found that transverse skin incision with dense adhesion consumed incision-to-delivery interval more than vertical. Greenberg et al[11] found that among women undergoing first repeat cesarean, severity of adhesions may delay delivery of the newborn. Thus, when a patient has a transverse skin incision, one with dense adhesion might delay the incision-to-delivery interval. Specifically, it could be critical, when the fetal is in a non-reassuring status. There was no crucial different statistic in internal organ injuries in this study. Wylie et al[7] found that there was no difference in repeated cesarean section among the group, whereas Shahrani[12] found that the incidence of bladder injury in repeat cesarean delivery was 0.22 percent. To clarify the clear view supporting the low incidence of bladder injury, it requires more reference groups of samples to provide a significant different result. In this study there was also no statistical difference between fetal injuries among the samples. This study found abrasion and forceps marked 18 and 11 fetuses in groups of transverse and vertical skin incision, respectively. Abrasion and forceps marks might be resulted from forceps extraction during the operation. The strengths of this study were the prospective study design, and no selective and collective bias. The limitation of this study was the small number in the vertical incision group. This study could not control the level of operator, anesthetic type, assistance in delivery and schedule/emergency conditions.

This study can be used as a clinical application. The transverse skin incision provides more chance of assistance of delivery (forceps extraction). Hence, skills in forceps extraction could be crucial for most surgeons who perform repeat cesarean delivery. It is important when fetus is in the non-reassuring status. If surgeons do not use forceps extraction, incision-to-delivery interval might be delayed. Repeated cesarean section has more chance to have complications between intra-operation. The pre-operative planning for repeat cesarean delivery may include evaluation of patient's risk, condition of fetus and surgeon expertise.

Conclusion

Vertical skin incision consumed less time than transverse skin incision in terms of incision-to-delivery interval and total operative time. Although, dense adhesions appeared in repeated cesarean section, the vertical skin incision still provided effective time usage. There was no difference in terms of internal organ injury, estimated blood loss, post-operative complications and neonatal outcomes from both types of skin incision.

Acknowledgement

This study was supported by a grant from the Rajavithi Hospital, Thailand. The authors thank the staff members for their cooperation.

Potential conflcts of interest

The authors declare no conflct of interest.

References

1. Cunningham FG, Leveno KJ, Bloom SL, Spong CY, Dashe Js, Hoffman BL, et al., editors. Williams Obstetrics. 24th ed. New York: McGraw-Hill; 2010.
2. World Health Organization. Appropriate technology for birth. Lancet 1985; 24:436-7.
3. Hanvoravongchai P, Letiendumrong J, Teerawattananon Y, Tangcharoensathien V. Implications of private practice in public hospitals on the cesarean section rate in Thailand. Human Resource Develop J 2000;4:2-12.
4. Wachiratarapadorn N, Kovavisarach E. Trend in mode of delivery in Rajavithi Hospital: a ten-year analysis (2002-2011). J Med Assoc Thai 2013;96:768-72.
5. Wuttikonsammakit P, Sukcharoen N. Pregnancy outcomes of multiple repeated cesarean sections in King Chulalongkorn Memorial Hospital. J Med Assoc Thai 2006;89:s81-6.
6. Khan FK, Yaqoob S, Kalsoom Z. Maternal morbidity associated with repeated cesarean sections. Biomedica 2012;28:134-7.
7. Wylie BJ, Gilbert S, Landon MB, Spong CY, Rouse DJ, Leveno KJ, et al. Comparison of transverse and vertical skin incision for emergency cesarean delivery. Obstet Gynecol 2010;115:1134-40.
8. Sibai BM, Newton ER. The urinary tract in pregnancy. In: Walters MD, Karram MM, editors. Urogynecology and Reconstructive Pelvic Surgery 2007. Philadephia: Mosby Elsevier 2007.p.472-89.
9. Rahman MS, Gasem T, Al Suleiman SA, Al Jama FE, Burshaid S, Rahman J. Bladder injuries during cesarean section in a University Hospital: a 25-year review. Arch Gynecol Obstet 2009;279:349-52.
10. Makoha FW, Fathuddien MA, Felimban HM. Choice of abdominal incision and risk of trauma to the urinary bladder and bowel in multiple cesarean sections. Eur J Obstet Gynecol Reprod Biol 2006;125:50-3.
11. Greenberg MB, Daniels K, Blumenfeld YJ, Caughey AB, Lyell DJ. Do adhesions at repeat cesarean delay delivery of the newborn?. Am J Obstet Gynecol 2011;205:380.e1-5.
12. Shahrani MA. Bladder injury during cesarean section: A Case Control Study for 10 years. Bahrain Med Bull 2012;34:125-32.