Archives of Gynecology and Obstetrics (2019) 299:135–139
https://doi.org/10.1007/s00404-018-4957-4

MATERNAL-FETAL MEDICINE

Bleeding control using intrauterine continuous running suture during cesarean section in pregnant women with placenta previa

Jung Min Ryu[1] · Yoon Seok Choi[1] · Jin Young Bae[1]

Received: 8 June 2018 / Accepted: 25 October 2018 / Published online: 1 November 2018

Abstract

Purpose The purpose of this study was to evaluate the effectiveness of intrauterine continuous running suture during cesarean section in pregnant women with placenta previa.

Methods We enrolled 277 women and medical records were retrospectively reviewed. Pregnant women were grouped according to uterine bleeding control methods as follows: Group A, using intrauterine continuous running suture and Group B (control group) using figure-of-eight suture.

Results Intrauterine continuous running sutures were used in 104 pregnant women. Mean total blood loss in Group A was significantly less than that in Group B (1332.70 ± 152.92 mL vs 1861.56 ± 157.74 mL, $P = 0.029$). Mean total transfusion unit of Group A was significantly less than that in Group B (1.74 ± 0.41 vs 3.52 ± 0.75, $P = 0.037$).

Conclusions Intrauterine continuous running sutures can significantly reduce postpartum blood loss and transfusion units during cesarean section in pregnant women with placenta previa.

Keywords Intrauterine continuous running suture · Placenta previa · Postpartum hemorrhage · Transfusion

Introduction

Postpartum hemorrhage is associated with 140,000 deaths in women annually worldwide [1, 2]. The Royal College of Obstetricians and Gynecologists (RCOG) defines life-threatening bleeding as an estimated blood loss of 2.5 L, transfusion of more than five units, or coagulopathy requiring treatment [3].

Placenta abnormality is one of the most important causes of obstetric hemorrhage [4]. Placenta abnormalities causing significant postpartum bleeding were placenta previa, placenta abruptio, placenta adherent, and remnant placenta [5, 6]. The incidence of placenta previa is approximately 4 in 1000 pregnant women (0.3–0.5%) [7]. It is increasing associated with the increase of cesarean section rate [8–10].

The fetuses of women with placenta previa need to be delivered by cesarean section. Heavy bleeding during cesarean section is still a challenging issue for obstetricians, because these women bleed more than those with a normally located placenta. Placenta previa has adverse outcomes for both the pregnant women and fetus and associated with the increase of morbidity and mortality [4].

To date, various surgical methods have been suggested to control hemorrhage of placenta previa. However, the safety and efficacy of these methods need further evaluation, because most studies were based on the experiences from a limited number of patients [11–16]. The purpose of this study was to evaluate the effectiveness of bleeding control using intrauterine continuous running suture during cesarean section in pregnant women with placenta previa.

Materials and methods

A total of 277 women with placenta previa delivered by cesarean section at Daegu Catholic University hospital between January 2007 and May 2017 were enrolled in this retrospective study. A retrospective review of medical records was conducted.

Patient characteristics, including age, body weight, body mass index (BMI), previous pregnancy frequency, previous Cesarean section frequency, neonatal body weight, Apgar

✉ Jin Young Bae
duchess7@naver.com

[1] Department of Obstetrics and Gynecology, School of Medicine, Catholic University of Daegu, Gyeongsan, South Korea

score (1 min/5 min), and previa type, were investigated. Total blood loss and total transfusion (T/F) unit, intra and post-operation transfusion unit (pack cell, platelet, and fresh frozen plasma), and duration of hospital stay were quantitatively estimated for estimating clinical outcome. We also assessed whether heavy bleeding (more than 2000, 3000, or 4000 mL), transfusion, intensive care unit (ICU) admission, disseminated intravascular coagulation (DIC), lower platelet ($< 100{,}000/mm^3$), re-operation, hysterectomy, uterine artery embolization, and/or iliac artery ligation occurred. This study was approved by the Ethics committees of the hospital.

Calculation of blood loss

We used the following mathematical model to calculate the exact amount of blood loss [17].

IBL = EBV (mL) × ln (pre-Hct/post-Hct)

ABL = (RBCs unit × 200 mL)/post-Hct

TBL = IBL + ABL.

Abbreviations: IBL intraoperative estimated blood loss volume, EBV estimated blood loss volume, ln natural logarithm, Hct hematocrit, ABL added a blood volume, RBC red blood cell, and TBL total blood loss volume

Intrauterine continuous running suture

Intrauterine continuous running sutures were defined as the bleeding control method with continuous running suturing in the inner surface of a lower segment or cervix. The details of the procedure are as follows.

After removal the placenta, the lower segment of the uterus was clamped with multiple sponge forceps to temporarily stop uterine incision edge bleeding. After exposure the intrauterine surface with adequate retraction, a continuous running suture of Vicryl 1–0 with an approximately 1-cm interval was placed at the bleeding site of the lower segment of the uterus. After a continuous running suture reached the end point in one direction, the returning running suture was continued until it reached the starting point. Multiple sutures of connected-alphabet-X shape were quickly obtained (Fig. 1a–c). The sutures could be repeatedly performed until adequate bleeding control was achieved.

The pregnant women were grouped into two groups based on intrauterine bleeding control methods: Group A, using intrauterine continuous running suture and Group B (or control group) using other methods, including figure-of-eight sutures.

Statistical analysis

The data were analyzed using IBM SPSS Statistics V25.0 (IBM, Armonk, NY, USA).

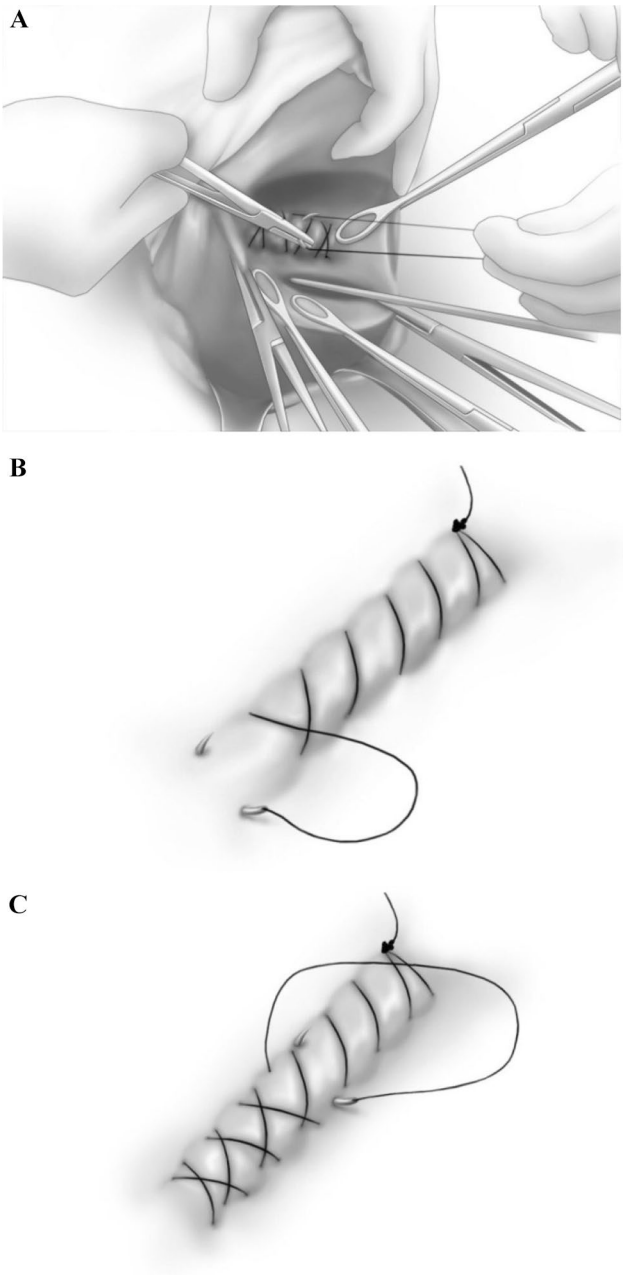

Fig. 1 **a** Lower segment of uterus was clamped with multiple sponge forceps for temporarily stopping the uterine incision edge bleeding. **b** Continuous running suture of Vicryl 1–0 with an approximately 1-cm interval was placed in the bleeding site of the lower segment of the uterus. After a continuous running suture in one direction reached the end point, the returning running suture was continued until it reached the starting point. **c** Multiple sutures of connected-alphabet-X shape could be obtained quickly

Comparisons of variables between the groups were based on the Chi-square test and independent samples *t* test. *P* values were the result of two-sided tests, and $P < 0.05$ was considered statistically significant.

Results

Of these 277 patients, 104 (38%) patients (Group A) received intrauterine running sutures, while 174 (62%) patients (Group B) received other bleeding control methods, including figure-of-eight sutures.

Patient characteristics were not different between groups (Table 1).

The amount of total blood loss and transfusion unit were significantly lower in Group A than those in Group B. The frequency of massive blood loss (above 4000 mL) was significantly lower in Group A than that in Group B ($P < 0.05$) (Tables 2, 3).

Follow-up physical examinations and ultrasonography 2–4 weeks postpartum showed no significant anatomical or physiological changes within the uterus. Furthermore, no complications such as obstruction of menstrual flow, endometritis, uterine synechiae, or pelvic inflammation were observed.

Discussion

Massive postpartum bleeding during cesarean section in pregnant women with placenta previa is one of the most challenging adverse events obstetricians have to manage. Although there is a wide variety of conservative management available, including bimanual uterine compression, intrauterine gauze packing, and uterotonics, they are not enough to prevent massive postpartum bleeding in this patient population. When ineffective, uterine compression suture, uterine artery embolization, uterine artery ligation, or hypogastric artery ligation can be used to preserve the uterus [18, 19].

Because the lower segment of the uterus contracts insufficiently compared to the uterine body, the lower segment in women with placenta previa is prone to bleeding after placenta delivery. Therefore, massive transfusion or aggressive surgical management such as hysterectomy is sometimes required to save the life of the patient [20, 21].

Table 1 Characteristics of women with placenta previa in this study

Variables	Group A	Group B	*P* value
Age (year)	33.72 ± 0.41	33.22 ± 0.32	0.332
Body weight (Kg)	66.49 ± 0.92	68.15 ± 0.73	0.163
BMI	25.94 ± 0.35	26.33 ± 0.25	0.345
Previous pregnancy frequency	0.61 ± 0.07	0.67 ± 0.06	0.506
Previous C/S frequency	0.27 ± 0.06	0.21 ± 0.04	0.419
Pregnancy period (day)	250.96 ± 2.45	254.3 ± 1.55	0.226
Neonatal body weight (g)	2610.18 ± 71.18	2733.44 ± 48.51	0.141
Apgar score (1 min)	7.75 ± 0.20	7.63 ± 0.13	0.593
Apgar score (5 min)	9.18 ± 0.17	9.16 ± 0.09	0.904
Previa type			
Totalis	36	60	0.991
Partialis	68	113	

C/S Cesarean section, *BMI* body mass index, *Kg* kilogram, *g* gram, *min* minute

Table 2 Clinical outcome by quantitative analysis

	Group A ($n = 104$)	Group B ($n = 173$)	*P* value
Total blood loss (mL)	1332.70 ± 152.92	1861.56 ± 157.74	0.017
Total T/F unit	1.74 ± 0.41	3.52 ± 0.75	0.037
Intra OP P/C T/F unit	0.78 ± 0.15	1.12 ± 0.14	0.118
Post OP P/C T/F unit	0.31 ± 0.11	0.66 ± 0.17	0.070
Total P/C T/F unit	1.09 ± 0.20	1.79 ± 0.26	0.063
Intra OP Plt T/F unit	0.00 ± 0.00	0.25 ± 0.11	0.029
Post OP Plt T/F unit	0.08 ± 0.08	0.51 ± 0.24	0.083
Intra OP FFP T/F unit	0.42 ± 0.11	0.34 ± 0.09	0.573
Post OP FFP T/F unit	0.15 ± 0.08	0.63 ± 0.20	0.027
Duration of hospital stay	5.04 ± 0.06	5.23 ± 0.08	0.062

Statistic method: independent samples *t* test

T/F transfusion, *OP* operation (Cesarean section), *P/C* pack cell, *Plt* platelet, *FFP* fresh frozen plasma

Table 3 Clinical outcome by crossover analysis

	Group A ($n = 104$)		Group B ($n = 173$)		*P* value
	Y	*N*	*Y*	*N*	
Blood loss > 4000 (mL)	4 (3.8%)	100	19 (10.9%)	154	0.037
Transfusion	34 (32.7%)	70	79 (45.7%)	94	0.033
ICU admission	0	104	1 (0.6%)	172	1.0
DIC	0	104	4 (2.3%)	169	0.301
Plt < 100,000 (/mm^3)	1 (0.9%)	103	5 (2.9%)	168	0.415
Re-operation	0	104	3 (1.7%)	170	0.294
Hysterectomy	4 (3.8%)	100	11 (6.4%)	162	0.371
Uterine artery embolization	0	104	1 (0.6%)	172	1.0
Iliac artery ligation	2 (1.9%)	102	10 (5.8%)	163	0.221

Statistic method: Chi-square test

ICU intensive care unit, *DIC* disseminated intravascular coagulation

Researchers have evaluated ways to reduce postpartum hemorrhage and preserve fertility among women with placenta previa undergoing a cesarean section. In particular, various uterine compression sutures have been recognized to reduce postpartum bleeding [11–16]. However, most of the studies that have been conducted were based on the experience gained from a few patients. Further studies are warranted to evaluate the safety and efficacy of the methods used to reduce postpartum hemorrhage. B-Lynch suture [12] and modified B-Lynch (e.g., Bhal [11], Hayman [15], and Hackethal suture [14]) are representative methods, and the suture technique involves penetrating the anterior and posterior uterine wall using a long needle.

As a result, because of the anterior and posterior uterine wall compression, these suturing methods can cause several complications, including uterine synechiae, suture site erosion, Asherman's syndrome, a localized or total area of uterine necrosis, hematometra, and pyometra [22–26]. In addition, compression sutures can lead to uterine outflow tract obstruction or uterine perfusion problem. Multiple longitudinal and transverse sutures (Pereira suture [16]) also lead to similar complications. Although multiple square sutures (Cho sutures [13]) were suggested, the study was based on the experiences from a limited number of patients. Furthermore, Cho sutures require experience and surgical skills, and it is a time-consuming process. Therefore, a new method to reduce postpartum hemorrhage that is simple, fast, and safe is necessary.

Our center has implemented intrauterine continuous running sutures in pregnant women with placenta previa for the past 10 years with outstanding outcomes. In this study, we demonstrated that intrauterine continuous running suture significantly decreased postpartum hemorrhage, total transfusion unit, and the frequency of massive blood loss (> 4000 mL) in women with placenta previa compared with other bleeding control methods. The frequency of ICU admission, DIC, hysterectomy, iliac artery ligation, and uterine artery embolization tended to decrease in Group A, but it did not reach a statistically significant difference, because only a small number of women had a poor clinical course.

Intrauterine continuous sutures have several advantages. They are fast and less time-consuming than simple interrupted sutures or figure-of-eight sutures. In effect, it creates multiple figure-of-eight sutures within a short time. In addition, these sutures can be performed without identifying the exact bleeding focus. This type of continuous suturing can be used to control bleeding, even though the sutures are applied around the bleeding focus.

Previous methods penetrate the anterior and posterior uterine wall may cause disturbance of uterine cavity drainage (infection, pyometra, and infertility), whereas intrauterine continuous suture does not.

Table 4 Sub-analysis result

	Group A ($n=40$)	Group B ($n=61$)	P value
Total blood loss (mL)	1001.36 ± 150.60	1605.15 ± 187.27	0.023
Total T/F unit	1.6 ± 0.79	2.51 ± 0.81	0.448
Intra OP P/C T/F unit	0.58 ± 0.28	0.80 ± 0.20	0.496
Post OP P/C T/F unit	0.25 ± 0.11	0.49 ± 0.14	0.178
Total P/C T/F unit	0.83 ± 0.31	1.30 ± 0.32	0.316
Intra OP pelt T/F unit	0	0.16 ± 0.16	0.421
Post OP pelt T/F unit	0.20 ± 0.20	0.39 ± 0.29	0.625
Intra OP FFP T/F unit	0.40 ± 0.20	0.61 ± 0.10	0.330
Post OP FFP T/F unit	0.18 ± 0.13	0.46 ± 0.17	0.186

Statistic method: independent samples t test

Table 4 shows the results of a sub-analysis from one of the surgeons in this study. The surgeon applied intrauterine continuous running sutures during cesarean sections to control bleeding in patients with placenta previa, since 2014. At that time, the author was a professional surgeon with more than 20 years of surgical experience.

Before 2014, the surgeon used other bleeding control methods during cesarean section, including figure-of-eight sutures, but after 2014, the surgeon performed 40 cesarean sections using intrauterine continuous running sutures. The surgeon did not change any other surgical skill during that time period. This sub-analysis demonstrates that bleeding control was not due to the difference in surgical skills among surgeons.

Altogether, these data suggest that intrauterine continuous running suture can significantly reduce total postpartum blood loss and total transfusion units during cesarean section in pregnant women with placenta previa.

Acknowledgements We can obtained good data through the efforts of one of the surgeons (Seong Yeon Hong) of Table 4.

Author contributions JMR MD conducted data collection, analysis, and manuscript writing. YSC MD, PhD conducted project development and data analysis of study. JYB MD, PhD conducted project development and manuscript writing.

Compliance with ethical standards

Conflict of interest There are no conflicts of interest to declare.

Ethical approval This retrospective study was approved by the Institutional Ethics Committee of Daegu Catholic University hospital Ethical approval. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institu-

tional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all individual participants included in the study.

References

1. O. American College of, Gynecologists (2006) ACOG Practice Bulletin: Clinical Management Guidelines for Obstetrician-Gynecologists Number 76, October 2006: postpartum hemorrhage. Obstet Gynecol 108(4):1039–1047
2. WHO (2012) WHO recommendations for the prevention and treatment of postpartum haemorrhage. WHO, Geneva
3. Dahlke JD, Mendez-Figueroa H, Maggio L, Hauspurg AK, Sperling JD, Chauhan SP, Rouse DJ (2015) Prevention and management of postpartum hemorrhage: a comparison of 4 national guidelines. Am J Obstet Gynecol 213(1):76 e1–76 e10
4. Widmer M, Blum J, Hofmeyr GJ, Carroli G, Abdel-Aleem H, Lumbiganon P, Nguyen TN, Wojdyla D, Thinkhamrop J, Singata M, Mignini LE, Abdel-Aleem MA, Tran ST, Winikoff B (2010) Misoprostol as an adjunct to standard uterotonics for treatment of post-partum haemorrhage: a multicentre, double-blind randomised trial. Lancet 375(9728):1808–1813
5. Shabana A, Fawzy M, Refaie W (2015) Conservative management of placenta percreta: a stepwise approach. Arch Gynecol Obstet 291(5):993–998
6. Wortman AC, Alexander JM (2013) Placenta accreta, increta, and percreta. Obstet Gynecol Clin North Am 40(1):137–154
7. Oyelese Y, Smulian JC (2006) Placenta previa, placenta accreta, and vasa previa. Obstet Gynecol 107(4):927–941
8. Faiz AS, Ananth CV (2003) Etiology and risk factors for placenta previa: an overview and meta-analysis of observational studies. J Matern Fetal Neonatal Med 13(3):175–190
9. Miller DA, Chollet JA, Goodwin TM (1997) Clinical risk factors for placenta previa-placenta accreta. Am J Obstet Gynecol 177(1):210–214
10. Wu S, Kocherginsky M, Hibbard JU (2005) Abnormal placentation: 20-year analysis. Am J Obstet Gynecol 192(5):1458–1461
11. Bhal K, Bhal N, Mulik V, Shankar L (2005) The uterine compression suture–a valuable approach to control major haemorrhage at lower segment caesarean section. J Obstet Gynaecol 25(1):10–14
12. Lynch CB, Coker A, Lawal AH, Abu J, Cowen MJ (1997) The B-Lynch surgical technique for the control of massive postpartum haemorrhage: an alternative to hysterectomy? Five cases reported. Br J Obstet Gynaecol 104(3):372–375
13. Cho JH, Jun HS, Lee CN (2000) Hemostatic suturing technique for uterine bleeding during cesarean delivery. Obstet Gynecol 96(1):129–131
14. Hackethal A, Brueggmann D, Oehmke F, Tinneberg HR, Zygmunt MT, Muenstedt K (2008) Uterine compression U-sutures in primary postpartum hemorrhage after Cesarean section: fertility preservation with a simple and effective technique. Hum Reprod 23(1):74–79
15. Hayman RG, Arulkumaran S, Steer PJ (2002) Uterine compression sutures: surgical management of postpartum hemorrhage. Obstet Gynecol 99(3):502–506
16. Pereira A, Nunes F, Pedroso S, Saraiva J, Retto H, Meirinho M (2005) Compressive uterine sutures to treat postpartum bleeding secondary to uterine atony. Obstet Gynecol 106(3):569–572
17. Brecher ME, Monk T, Goodnough LT (1997) A standardized method for calculating blood loss. Transfusion 37(10):1070–1074
18. Blanc J, Courbiere B, Desbriere R, Bretelle F, Boubli L, D'Ercole C, Carcopino X (2012) Uterine-sparing surgical management of postpartum hemorrhage: is it always effective? Arch Gynecol Obstet 285(4):925–930
19. Doumouchtsis SK, Papageorghiou AT, Arulkumaran S (2007) Systematic review of conservative management of postpartum hemorrhage: what to do when medical treatment fails. Obstet Gynecol Surv 62(8):540–547
20. Knight M (2007) Ukoss, Peripartum hysterectomy in the UK: management and outcomes of the associated haemorrhage. BJOG 114(11):1380–1387
21. Zwart JJ, Dijk PD, van Roosmalen J (2010) Peripartum hysterectomy and arterial embolization for major obstetric hemorrhage: a 2-year nationwide cohort study in the Netherlands. Am J Obstet Gynecol 202(2):150 e1–150 e7
22. El-Hamamy E (2005) Partial ischemic necrosis of the uterus following a uterine brace compression suture. BJOG 112(1):126
23. Mallappa Saroja CS, Nankani A, El-Hamamy E (2010) Uterine compression sutures, an update: review of efficacy, safety and complications of B-Lynch suture and other uterine compression techniques for postpartum haemorrhage. Arch Gynecol Obstet 281(4):581–588
24. Ochoa M, Allaire AD, Stitely ML (2002) Pyometria after hemostatic square suture technique. Obstet Gynecol 99(3):506–509
25. Treloar EJ, Anderson RS, Andrews HS, Bailey JL (2006) Uterine necrosis following B-Lynch suture for primary postpartum haemorrhage. BJOG 113(4):486–488
26. Wu HH, Yeh GP (2005) Uterine cavity synechiae after hemostatic square suturing technique. Obstet Gynecol 105(5 Pt 2):1176–1178