Research Square

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A Novel Procedure to Preserve Uterus in Women with Placenta Accreta Spectrum: Efficacy of King's Combined Uterine Suture — A Retrospective Cohort Study

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Abstract

Background:

Placenta accreta spectrum (PAS) is frequently associated with severe postpartum hemorrhage, resulting in high probability of hysterectomy during cesarean. Identifying conservative surgical approaches that preserve the uterus is therefore of considerable clinical importance. This study evaluated the clinical efficacy of a innovative uterus-preserving intervention, King's Combined Uterine Suture Technique (KCUST), in reducing hysterectomy rate.

Materials and Methods:

We conducted a retrospective study of women who underwent cesarean delivery and were diagnosed with PAS at Fujian Maternity and Child Health Hospital between January 2017 and June 2025. Participants were allocated into two groups according to the hemostatic technique used: the KCUST group and the conventional hemostatic group. The primary outcome was the hysterectomy rate, while secondary outcomes included hemorrhage-related complications. Propensity score-based inverse probability weighting was applied to balance baseline characteristics, and regression models were used for outcome analysis.

Results:

A total of 193 women were diagnosed with PAS.Of these, 60 (31%) received KCUST, while 133 women (69%) received conventional hemostatic approaches. Compared with the conventional hemostatic group, the KCUST group demonstrated a significantly lower risk of hysterectomy (OR = 0.17, 95% CI: 0.03–0.61). No significant differences were observed between the two groups in intraoperative blood loss, intraoperative transfusion volume, operative time, incidence of postpartum hemorrhage, and postoperative infection.

Conclusion:

KCUST significantly reduces the risk of hysterectomy in women with PAS, thereby preserving fertility and providing a feasible conservative surgical option.

Introduction

Placenta accreta spectrum (PAS) refers to the abnormal invasion of the placenta into the myometrium, which prevents placental separation during delivery and often leads to severe postpartum hemorrhage (PPH), probably requiring emergency hysterectomy during or after a cesarean section[1–3]. Previous studies have shown that cesarean delivery is a major risk factor for PAS, which in turn leads to a higher

frequency of peripartum hysterectomy[4, 5]. Even in cases of early pregnancy termination, the risks of massive hemorrhage or hysterectomy remains comparable with expectant management carried to term. Hysterectomy, however, leads to irreversible fertility loss and imposes substantial long-term physical and psychological sequelae[6]. Accordingly, PAS not only poses an immediate threat to maternal survival[7] but also presents a substantial clinical challenge given its frequent association with hysterectomy. The development of reliable hemostatic techniques that simultaneously safeguard uterine preservation is therefore of paramount importance.

Studies indicate that 16% of women with PAS require a cesarean hysterectomy[8]. To reduce the incidence of hysterectomy associated with PAS, several conservative surgical techniques have been developed and implemented. These include various uterine compression sutures (e.g., B-Lynch suture, Cho suture)[9, 10], preoperative or intraoperative vascular interventions (e.g., uterine artery or internal iliac artery balloon occlusion/embolization)[11, 12], and targeted vascular ligation techniques, among others. A central objective of these interventions is to control life-threatening hemorrhage while preserving the uterus. Nonetheless, current evidence indicates that no single technique has been established as a universally accepted "gold standard" capable of consistently ensuring both effective hemostasis and high rates of uterine preservation in all PAS cases[13]. This underscores the need for further innovation to reduce reliance on cesarean hysterectomy.

To address the urgent clinical need for uterine preservation in PAS women, our team introduced the King's Combined Uterine Suture Technique (KCUST) in 2017 as a novel conservative surgical approach[14]. KCUST combines uterine cavity vessel ligation with longitudinal suturing of lower uterine segment vessels[15], aiming to reduce the risks of postpartum hemorrhage and hysterectomy. After eight years of implementation at our institution, we sought to evaluate its clinical efficacy through a comprehensive analysis of hospital-based data.

Materials and Methods

This retrospective analysis included women with PAS who underwent cesarean delivery at a large tertiary referral center, which manages approximately 20,000 deliveries annually, between January 2017 and June 2025. A total of 205 women with complete clinical records and ultrasound-confirmed PAS were initially identified. The ultrasound diagnosis of PAS was established according to the criteria of the American College of Obstetricians and Gynecologists (ACOG)[16]: (1) mid-to-late trimester pregnancy; (2) multiple irregular vascular lacunae with turbulent flow on color Doppler imaging; (3) loss of the normal hypoechoic zone (decidual layer) between the placenta and myometrium, with retroplacental myometrial thickness < 1 mm; (4) indistinct uterine serosa–bladder interface or evidence of placental invasion into the bladder; and (5) increased subplacental vascularity, loss of the clear zone, or abnormal vascular connections at the placental–uterine margin. Inclusion criteria were: (1) fulfillment of PAS ultrasound diagnostic standards; (2) singleton, live pregnancy; (3) cesarean delivery; and (4) absence of severe preoperative coagulopathy. Exclusion criteria were: (1) twin or multiple gestations; (2) emergency cesarean delivery; and (3) major systemic diseases, such as severe cardiac, hepatic, renal, or pulmonary

dysfunction. After applying these criteria, 193 women were deemed eligible. In all cases, PAS was confirmed histologically after delivery. Participants were stratified by hemostatic technique used: the study group (n = 60) underwent KCUST, whereas the control group (n = 133) received conventional hemostatic approaches. (Fig. 1).

KCUST was performed with women in the supine position following standard laparotomy (see Fig. 2). If pelvic adhesions were present, adhesiolysis must be performed. Segmental ligation of the engorged vessels on the uterine surface was performed. The hysterotomy was made at the site without placental insertion. After fetal delivery, the placenta was deliberately left in situ. The uterus was exteriorized and packed posteriorly with gauze pads. Temporary hemostasis was achieved using 6–8 atraumatic oval clamps applied along the hysterotomy edges and the placental bed. The bladder was dissected down to the level of the internal cervical os. Subsequently, three key procedural steps were performed. Step 1 was bilateral parauterine vascular ligation: the ligation was placed below the incision, which should be low enough even extending to the cervix if necessary. After the uterine artery was identified by a finger, an absorbable suture was inserted at a point approximately 2–3 cm medial to the artery, passed through the uterine walls from anterior to posterior. Then the suture was passed from posterior to anterior through the avascular area of the uterine broad ligament, and the vessels were tied. The same procedure was repeated on the contralateral side. Step 2 Selective utero-ovarian ligation (if persistent bleeding after step 1): the suture was inserted below the round ligament and about 2–3 cm from the lateral uterine edge, and applied following the same technique as in Step 1. Step 3 Longitudinal compression suture of the lower uterine segment. If no significant hemorrhage was observed, the placenta was delivered. An absorbable suture was inserted 1–2 cm from the lateral uterine border and approximately 1 cm above the internal cervical os passing from anterior to posterior through the uterine wall; then suture was inserted 3–4 cm medial to the lateral uterine border and 1 cm below the upper edge of the uterine incision, passing from posterior to anterior through the uterine wall. The knot was tied on the anterior uterine wall. The same procedure was repeated on the contralateral side. If hemostasis is achieved but a significant defect remains on the anterior uterine wall, uterine reconstruction should be performed, followed by uterine closure and standard layered abdominal closure. (see Fig. 3). In the conventional hemostasis group, the procedure was performed after fetal delivery but before placental expulsion. Bilateral ligation of the ascending uterine artery branches was performed first, followed by additional measures such as tourniquet application, intrauterine balloon tamponade, uterine packing, or figure-of-eight sutures, depending on the intraoperative hemostatic response.

Peripartum hysterectomy was performed in cases of uncontrolled intraoperative hemorrhage. The study endpoints included: operative duration, intraoperative blood loss, intraoperative transfusion volume, occurrence of hysterectomy, and incidence of PPH.

Clinical and demographic data were extracted from the electronic registration system. Continuous variables included age, height, weight, gestational age, and preoperative hemoglobin level. Ordinal categorical variables comprised gravidity (1, 2, or ≥ 3), parity (1, 2, or ≥ 3), and the number of previous cesarean deliveries (1, 2, or ≥ 3). Binary or nominal categorical variables included gestational

hypertension (yes/no), gestational diabetes mellitus (yes/no), type of placenta previa (complete vs. other), placenta percreta (yes/no), ethnicity (Han Chinese vs. other Chinese ethnic minorities), educational attainment (bachelor's degree or above, high school, middle school, or primary school), and marital status (unmarried, married, or divorced). To address confounding in this retrospective cohort, we employed inverse probability of treatment weighting (IPTW) based on propensity scores (PS). Covariates included age, gestational age, gravidity, parity, cesarean count, placenta previa type, and preoperative hemoglobin. Firth's penalized logistic regression was applied for PS estimation, introducing a penalty term to maximize the partial likelihood. This approach reduces quasi-complete separation bias and improves reliability in small samples where conventional logistic regression may fail. IPTW weights were calculated as the inverse of the estimated PS, creating a pseudo-population that balanced covariate distributions across groups and approximated randomized trial conditions. Covariate balance was assessed via standardized mean differences (SMDs)[17] (see Table S1). Outcome measures, included intraoperative blood loss, intraoperative transfusion volume, operation time, postpartum hemorrhage (yes/no), hysterectomy (yes/no), and postoperative infection (yes/no). Continuous outcomes were analyzed using weighted linear regression, while binary outcomes were analyzed using weighted Firth's logistic regression. Intraoperative blood loss (mL) was quantified by combining volumetric and gravimetric methods, calculated as the volume of blood collected by suction plus the difference between the weight of blood-soaked gauzes and their pre-use weight divided by the blood density (1.05 g/mL), excluding non-blood fluids such as amniotic fluid. Intraoperative transfusion volume was defined as the total volume (mL) of packed red blood cells and fresh frozen plasma administered during surgery, as recorded in anesthesia charts. Operation time was defined as the duration from initial incision to skin closure (minutes), obtained directly from the operative anesthesia system. Postpartum hemorrhage was defined as a cumulative blood loss ≥ 1000 mL within 24 hours after delivery[18]. Hysterectomy status was determined from operative notes, and postoperative infection was identified according to explicit notations in the maternal case report forms within the electronic medical record system.

In accordance with the Declaration of Helsinki, this study was retrospectively registered on the Open Science Framework (OSF). The unique identifying number (UIN) is 7q8p9 (Hyperlink: https://osf.io/7q8p9).

Subsequent univariable and multivariable analyses were conducted to identify additional potential confounders influencing obstetric outcomes. In the univariable analysis, variables showing statistically significant between-group difference ($p < 0.05$), beyond the pre-specified covariates, were incorporated into the multivariable models for adjustment. All analyses were conducted using SAS version 9.4 and RStudio 2025.05. Continuous variable distributions were evaluated for normality via Shapiro-Wilk and Kolmogorov-Smirnov tests, with normally distributed parameters expressed as mean ± standard deviation and non-normally distributed parameters as median (interquartile range). Categorical variables were reported as frequencies (percentages). Between-group comparisons were made using Student's t-test or Wilcoxon rank-sum test for continuous variables (depending on distribution), and χ^2 test or Fisher's exact test (for expected cell counts < 5) for categorical variables. A two-tailed $p < 0.05$ was considered statistically significant.

Results

The study flowchart is presented in Fig. 1. Among the 193 women enrolled, 60 (31%) were assigned to the intervention group receiving KCUST, while the remaining 133 women (69%) to the control group undergoing conventional hemostatic approaches. Baseline demographic characteristics were generally comparable between the two groups (Table 1), with statistically significant differences were observed only in parity,number of prior cesarean deliveries, and type of placenta previa. Most women were multiparous. A significantly higher proportion of women in the KCUST group had a parity of ≥ 3 (35% vs. 13%). Regarding previous cesarean deliveries, two prior cesareans were most common in the KCUST group (68%), whereas one prior cesarean was predominant in the conventional hemostasis group (49%). In addition, complete placenta previa was more prevalent in the KCUST group than in the control group (75% vs. 57%).

Table 1
Baseline demographic and clinical characteristics of the study population

Parameter	KCUST (n = 60)	non-KCUST (n = 133)	P value
Maternal age (y)	33 ± 4	33 ± 5	0.574
BMI at delivery (kg/m^2)	26 ± 4	27 ± 3	0.643
Gestational age at delivery (wk)	36 (35–37)	37 (35–38)	0.285
Pre-operative hemoglobin(g/L)	114 ± 13	114 ± 14	0.911
Gravidity			
1	3 (5)	1 (1)	0.177
2	11(18)	26 (20)	
≥ 3	46 (77)	106 (79)	
Parity			
1	6 (10)	38 (29)	< .001
2	33 (55)	77 (58)	
≥ 3	21 (35)	18 (13)	
Cesarean count			
1	10 (17)	65 (49)	< .001
2	41 (68)	61 (46)	
≥ 3	9 (15)	7 (5)	
Gestational hypertension			
Yes	4 (7)	9 (7)	1.000
No	56 (93)	124 (93)	
Gestational diabetes mellitus			
Yes	20 (33)	42 (32)	0.809
No	40 (67)	91 (68)	
Placenta previa type			
Complete placenta previa	45 (75)	75 (57)	0.010
Another placenta previa	15 (25)	58 (43)	
Penetrating Placenta Accreta			
Yes	5 (8)	7 (5)	0.521

Parameter	KCUST (n = 60)	non-KCUST (n = 133)	P value
No	55 (92)	126 (95)	
Ethnic identity			
Han Chinese	56 (93)	127 (95)	0.504
Others	4 (7)	6 (5)	
Educational level			
Bachelor's degree or above	28 (47)	43 (32)	0.257
High school or vocational school	14 (23)	44 (33)	
Junior high school	17 (28)	41 (31)	
Primary school	1 (2)	5 (4)	
Marital status			
Unmarried	4 (7)	11 (8)	0.417
Married	54 (90)	121 (91)	
Divorced	2 (3)	1 (1)	
BMI: Body Mass Index			

After PS weighting, all covariates achieved SMDs < 0.1 confirming comparability comparability of key baseline characteristics between groups and substantially reducing the risk of potential confounding bias (Table S1). Following PS matching and inverse probability weighting, a virtual cohort of 371 women was generated, comprising 177 women in the KCUST group and 194 women in the non-KCUST group. As shown in Table 2, weighted regression analysis showed that the KCUST group had a significantly lower rate of hysterectomy compared with the non-KCUST group, corresponding to an 83% reduction in risk (odds ratio [OR] = 0.17; 95% confidence interval [CI]: 0.03–0.61; P = 0.004). No statistically significant differences were observed between the two groups in terms of intraoperative blood loss, intraoperative blood transfusion volume, operative time, incidence of postpartum hemorrhage, or postoperative infection.

Table 2
Clinical outcomes associated with KCUST

Parameter	Before weighting	After weighting	Before weighting	After weighting	
	KCUST (n = 60)	KCUST (n = 177)	Non-KCUST (n = 133)	Non-KCUST (n = 194)	P value (weighting)
Intraoperative Blood Loss (mL)	1475 ± 1829	1344 ± 1524	1440 ± 1901	1584 ± 2140	0.375
Intraoperative Blood Transfusion Volume(mL)	988 ± 1313	909 ± 1188	715 ± 1726	817 ± 1881	0.687
Operative time(minutes)	120 ± 62	111 ± 50	93 ± 52	96 ± 56	0.062
Postpartum Hemorrhage	24 (30)	69 (39)	52 (39)	77 (40)	0.860
Hysterectomy	1 (2)	2 (1)	8 (6)	13 (7)	*0.004
Postoperative Infection	2 (3)	6 (3)	6 (5)	8 (4)	0.775

To investigate potential con founders influencing hysterectomy, we conducted univariate and multivariate analyses comparing groups stratified by hysterectomy status. The analyses showed that preoperative hemoglobin (OR = 0.87, 95% CI 0.78–0.95), KCUST (OR = 0.02, 95% CI 0.00–0.35), penetrating placenta accreta (OR = 222, 95% CI 17.4–19200), and placenta previa type (OR = 0.02, 95% CI 0.00–0.62) were independent risk factors for hysterectomy during cesarean delivery in women with placental invasion. (See Supplementary Table 1)

To assess the robustness of the primary IPTW regression analysis, we performed a sensitivity analysis incorporating the above covariates (data not shown). The results of the sensitivity analysis were highly consistent with those of the primary analysis: the OR for hysterectomy was 0.18 (95% CI: 0.03–0.62, P = 0.005). These findings demonstrate the significant protective effect of KCUST against hysterectomy.

Comment

In women with PAS undergoing cesarean delivery, the KCUST technique proposed in this study reduced the risk of hysterectomy by 83% than conventional hemostatic methods. Importantly, no significant differences were observed in other secondary outcomes, indicating that KCUST decreases hysterectomy risk without increasing other perioperative complications.

Our findings align with research from Vietnam[19], which utilized the Modified One-Step Conservative Uterine Surgery (MOSCUS) technique. This procedure, combining bilateral uterine artery ligation with a transverse B-Lynch compression suture, lowered hysterectomy rates but had a notable failure rate, with

11% (24/217) of women ultimately requiring hysterectomy. The KCUST builds upon uterine artery ligation by incorporating selective ligation of utero-ovarian communicating branches and longitudinal suturing of the lower uterine segment. The latter follows the orientation of myometrial fibers, thereby enhancing contractility and compressing vascular stumps, which likely explains the superior uterine preservation observed in our study.

The study by Sergey V. Barinov et al.[20] suggested that uterine artery ligation is less effective for extensive PAS disorders. This is consistent with the pathophysiology of PAS, as extensively implanted placental tissue establishes an aberrant blood supply derived from collateral circulation, thereby circumventing the ligated main uterine arteries. Their Zhukovsky double-balloon method also relied primarily on blood flow obstruction, with similar limitations. By contrast, KCUST combines blood flow reduction with a longitudinal suture that increases myometrial tension and enhances physiological contraction at bleeding sites, providing more effective hemostasis in extensive PAS.

Prophylactic infrarenal abdominal aortic balloon occlusion (IAABO), which has also been shown to reduce hysterectomy rate[21]. Prophylactic IAABO temporarily occludes the aorta during surgery, thereby creating a bloodless surgical field for managing placenta accreta. This technique significantly reduces the risk of intraoperative hemorrhage; however, its application is associated with non-negligible limitations. However, its use is constrained by technical demands, the need for an interventional radiology team, and risks such as vascular injury, thrombosis, distal ischemia, and contrast-related complications. Compared with IAABO, KCUST offers distinct advantages in accessibility, clinical safety, and efficiency. The operative duration of KCUST was approximately 60 minutes shorter than that of IAABO. A shorter operative time translates to reduced maternal anesthesia exposure and a lower risk of complications.

In women with PAS, trophoblast invasion induces neovascularization that anastomoses with the arteries. This abnormal vascular network substantially increases the risk of catastrophic hemorrhage during surgery[22]. During placental removal, disruption of these vessels may render hemostasis impossible. Consequently, if placental detachment proves unfeasible, the Royal College of Obstetricians and Gynaecologists (RCOG) advises leaving the placenta in situ followed by definitive hysterectomy[23]. Common conservative management strategies, such as balloon occlusion of the internal iliac or abdominal aorta, work by reducing blood flow to the lower limbs, thereby lowering hemorrhage risk during placental separation. But it may increase the risk of lower limb ischemia due to prolonged surgical time. KCUST offers a uterus-preserving technique by ligating parauterine vessels and selectively occluding utero-ovarian collaterals without compromising limb perfusion. Moreover, longitudinal compression sutures applied to the lower uterine segment before placental expulsion reinforce weakened myometrial tissue, enhance contractility, and effectively reduce bleeding from exposed sinuses.

This study provides robust evidence supporting the efficacy of KCUST during cesarean delivery in women with PAS, enabling uterine preservation through conservative surgical management. Although

designed as a retrospective cohort study, we employed rigorous methodology, including propensity score matching with inverse probability of treatment weighting (PSM-IPTW) followed by weighted regression analysis to minimize cofounding. Nevertheless, limitations exist as these findings derive from a single-center retrospective analysis at Fujian Maternity and Child Health Hospital. Prospective validation through multi-center studies and ultimately randomized controlled trials (RCTs) is essential to establish generalizability and facilitate broader clinical adoption of this novel technique.

Conclusion

In women undergoing cesarean delivery for PAS, KCUST significantly reduced hysterectomy rates, offering an effective uterus-preserving surgical alternative.

Abbreviations

PAS placenta accreta spectrum

PPH postpartum hemorrhage

KCUST King's Combined Uterine Suture Technique

ACOG American College of Obstetricians and Gynecologists

IPTW inverse probability of treatment weighting

PS propensity scores

SMDs standardized mean differences

OR Odds Ratio

CI Confidence Interval

Declarations

Ethics approval and consent to participate

The study protocol was approved by the Institutional Ethics Committee of Fujian Maternity and Child Health Hospital (approval No. 2025KY112). The requirement for informed consent was waived owing to the use of de-identified data. All methods were carried out in accordance with relevant guidelines and regulations and the principles of the Declaration of Helsinki.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

Funding

Author Contribution

JJ, JY and JL were involved in the conceptualization of the study. WY, HL, JL, NJ, QH performed the data acquisition, processing, and analysis. All authors were involved in the data interpretation. HL wrote the primary draft. All authors revised it critically for intellectual content and approved the final version. JJ, JY and HY had full access to all the data in the study and took responsibility for the integrity of the data and the accuracy of the data analysis. JJ, JY and JL are the guarantors.

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Not applicable.

Data Availability

The data supporting the conclusions of this article can be obtained from the corresponding author upon reasonable request.

References

1. Silver RM, Branch DW. Placenta Accreta Spectrum. N Engl J Med. 2018;378(16):1529–36.
2. Shanks A, McNamara J, Hua M, McPherson J. Discussion: 'Predictors of massive blood loss from placenta accreta' by Wright et al. Am J Obstet Gynecol. 2011;205(1):e8–10.
3. Matsuzaki S, Mandelbaum RS, Sangara RN, McCarthy LE, Vestal NL, Klar M, Matsushima K, Amaya R, Ouzounian JG, Matsuo K. Trends, characteristics, and outcomes of placenta accreta spectrum: a national study in the United States. Am J Obstet Gynecol. 2021;225(5):e534531–8.
4. Soleymani Majd H, Collins SL, Addley S, Weeks E, Chakravarti S, Halder S, Alazzam M. The modified radical peripartum cesarean hysterectomy (Soleymani-Alazzam-Collins technique): a systematic, safe procedure for the management of severe placenta accreta spectrum. Am J Obstet Gynecol. 2021;225(2):e175171–175110.
5. Silver RM, Barbour KD. Placenta accreta spectrum: accreta, increta, and percreta. Obstet Gynecol Clin North Am. 2015;42(2):381–402.

6. Pan S, Han M, Zhai T, Han Y, Lu Y, Huang S, Zuo Q, Jiang Z, Ge Z. Maternal outcomes of conservative management and cesarean hysterectomy for placenta accreta spectrum disorders: a systematic review and meta-analysis. BMC Pregnancy Childbirth. 2024;24(1):463.
7. Fonseca A, Ayres de Campos D. Maternal morbidity and mortality due to placenta accreta spectrum disorders. Best Pract Res Clin Obstet Gynaecol. 2021;72:84–91.
8. Alina WB, Elias C, Eran K, Lior F, Nizan M, Gabriel L, Hila LE, Raanan M. Outcomes of cesarean delivery in placenta accreta: conservative delivery vs. cesarean hysterectomy. J Perinat Med. 2024;52(1):22–9.
9. C BL, Coker A, Lawal AH, Abu J, Cowen MJ. The B-Lynch surgical technique for the control of massive postpartum haemorrhage: an alternative to hysterectomy? Five cases reported. Br J Obstet Gynaecol. 1997;104(3):372–5.
10. Cho JH, Jun HS, Lee CN. Hemostatic suturing technique for uterine bleeding during cesarean delivery. Obstet Gynecol. 2000;96(1):129–31.
11. D'Souza DL, Kingdom JC, Amsalem H, Beecroft JR, Windrim RC, Kachura JR. Conservative Management of Invasive Placenta Using Combined Prophylactic Internal Iliac Artery Balloon Occlusion and Immediate Postoperative Uterine Artery Embolization. Can Assoc Radiol J. 2015;66(2):179–84.
12. Mei Y, Luo D, Lin Y. Clinical application of prophylactic internal iliac artery balloon occlusion combined with uterine artery embolization in patients with abnormally invasive placenta. J Matern Fetal Neonatal Med. 2018;31(24):3287–92.
13. Einerson BD, Gilner JB, Zuckerwise LC. Placenta Accreta Spectrum. Obstet Gynecol. 2023;142(1):31–50.
14. Xia L, Lin J, Dai Y, Wang X. Study on the application of King's combined uterine suture for hemostasis during cesarean section. BMC Pregnancy Childbirth. 2021;21(1):762.
15. You W, Lin J, Hu L. Efficacy of King's Combined Uterine Suture in Managing Placenta Accreta: A Retrospective Analysis. Med Sci Monit. 2025;31:e945826.
16. Obstetric Care Consensus No. 7: Placenta Accreta Spectrum. Obstet Gynecol. 2018;132(6):e259–75.
17. Cohen J. Statistical Power Analysis for the Behavioral Sciences: Routledge.
18. [Guidelines for prevention and treatment of postpartum hemorrhage. (2023)]. *Zhonghua Fu Chan Ke Za Zhi* 2023, 58(6):401–409.
19. Vuong ADB, Pham TH, Pham XTT, Truong DP, Nguyen XT, Trinh NB, Nguyen DV, Nguyen YON, Nguyen T, Ho QN, et al. Modified one-step conservative uterine surgery (MOSCUS) versus cesarean hysterectomy in the management of placenta accreta spectrum: A single-center retrospective analysis based on 619 Vietnamese pregnant women. Int J Gynaecol Obstet. 2024;165(2):723–36.
20. Barinov SV, Di Renzo GC. A new technique to preserve the uterus in patients with placenta accreta spectrum disorders. Am J Obstet Gynecol. 2024;230(3s):S1107–15.

21. Gu Y, Zhou Y, Li L, Li H, Wang S, Wang Y, Zuo C. Cook Cervical Ripening Balloon for placenta accreta spectrum disorders with placenta previa: a novel approach to uterus preserving. Arch Gynecol Obstet. 2022;306(6):1979–87.
22. Kingdom JC, Hobson SR, Murji A, Allen L, Windrim RC, Lockhart E, Collins SL, Soleymani Majd H, Alazzam M, Naaisa F, et al. Minimizing surgical blood loss at cesarean hysterectomy for placenta previa with evidence of placenta increta or placenta percreta: the state of play in 2020. Am J Obstet Gynecol. 2020;223(3):322–9.
23. Fitzpatrick KE, Sellers S, Spark P, Kurinczuk JJ, Brocklehurst P, Knight M. The management and outcomes of placenta accreta, increta, and percreta in the UK: a population-based descriptive study. BJOG. 2014;121(1):62–70. discussion 70–61.

Figures

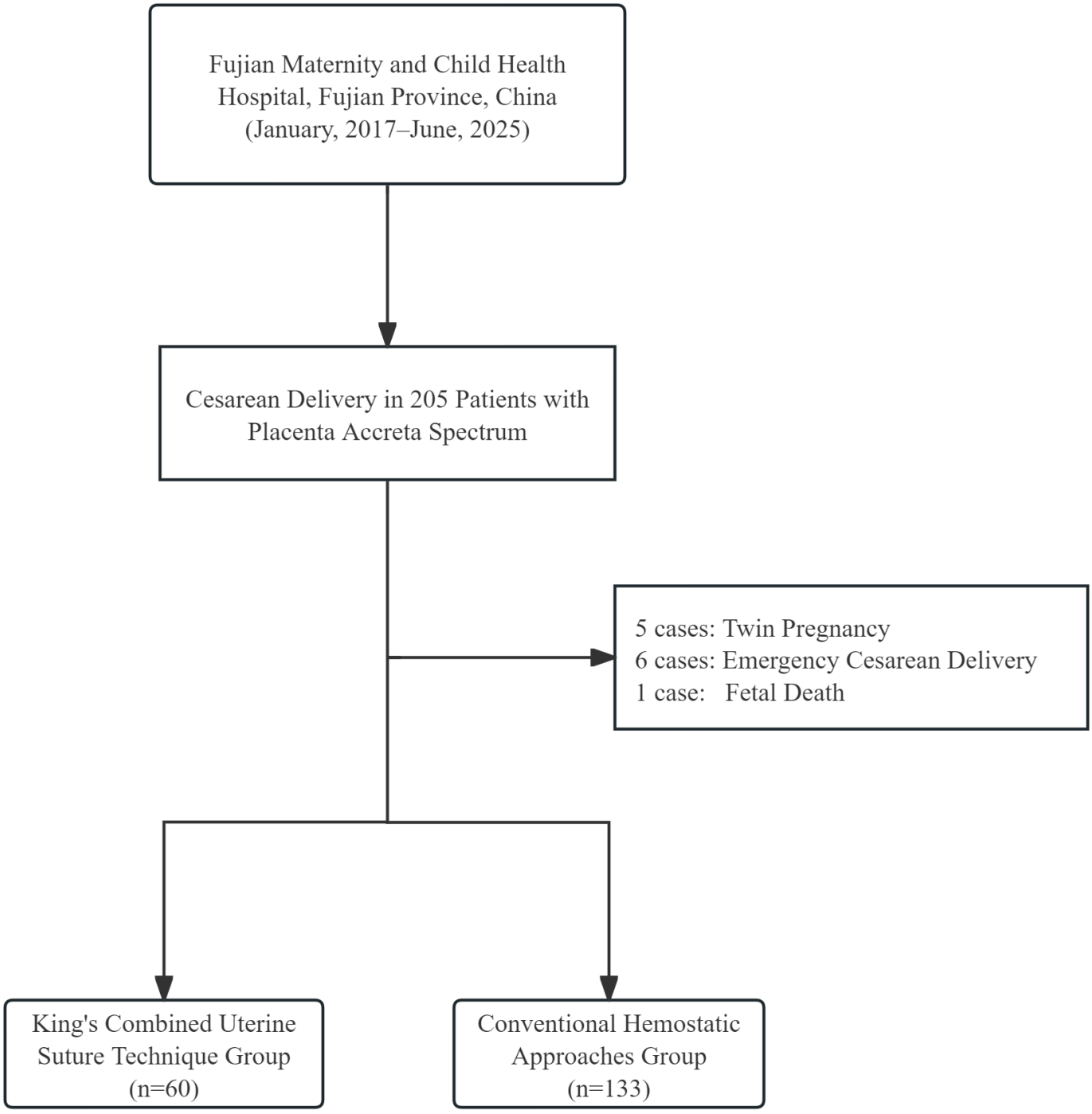


Figure 1

Study profile

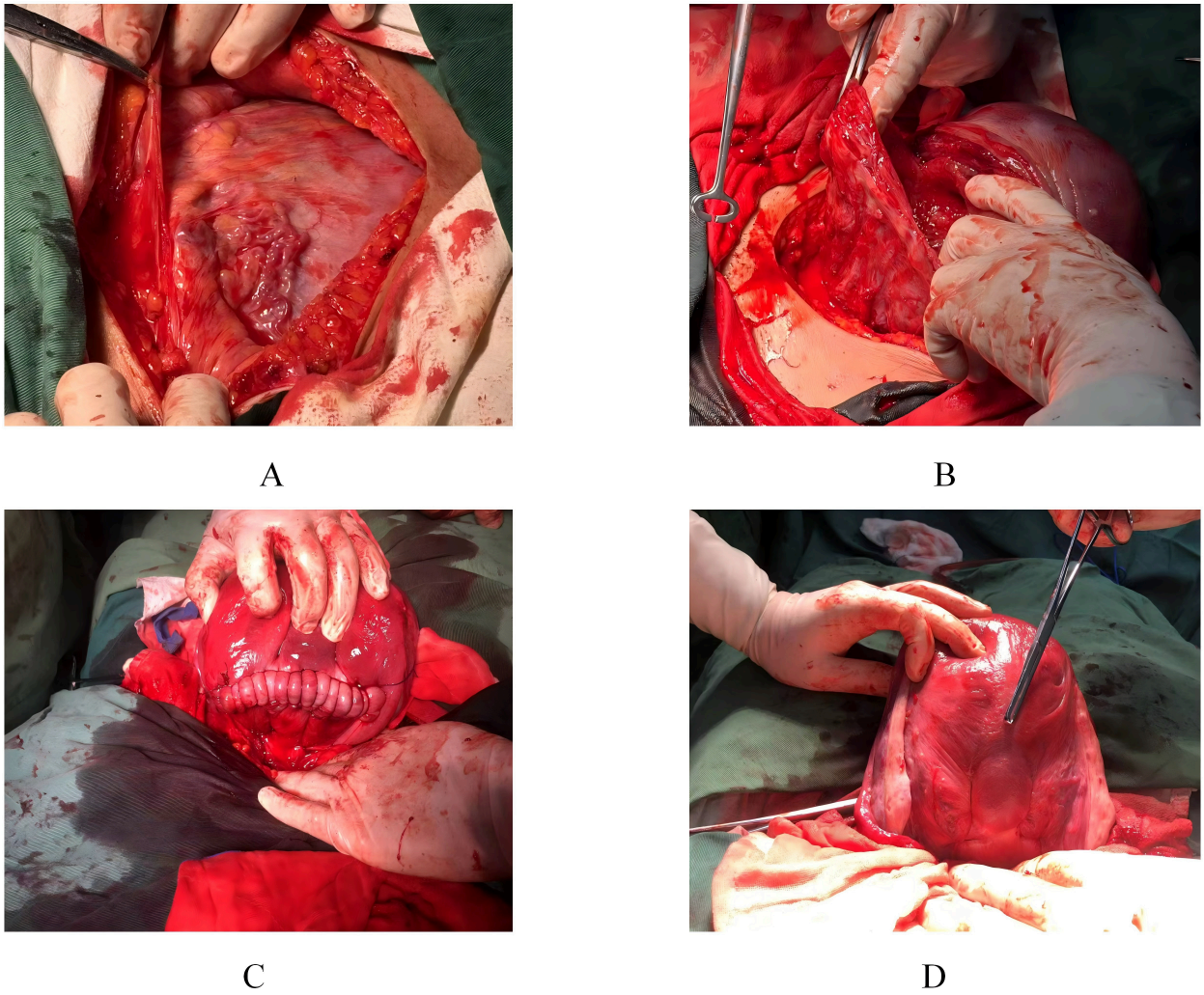


Figure 2

Results of King's Combined Uterine Suture Technique

A,Evidence of placenta accreta with increased vascularity on the anterior uterine wall.

B,Uterine reconstruction.

C,Anterior view of the completed uterine suture.

D,Posterior view of the completed uterine suture.

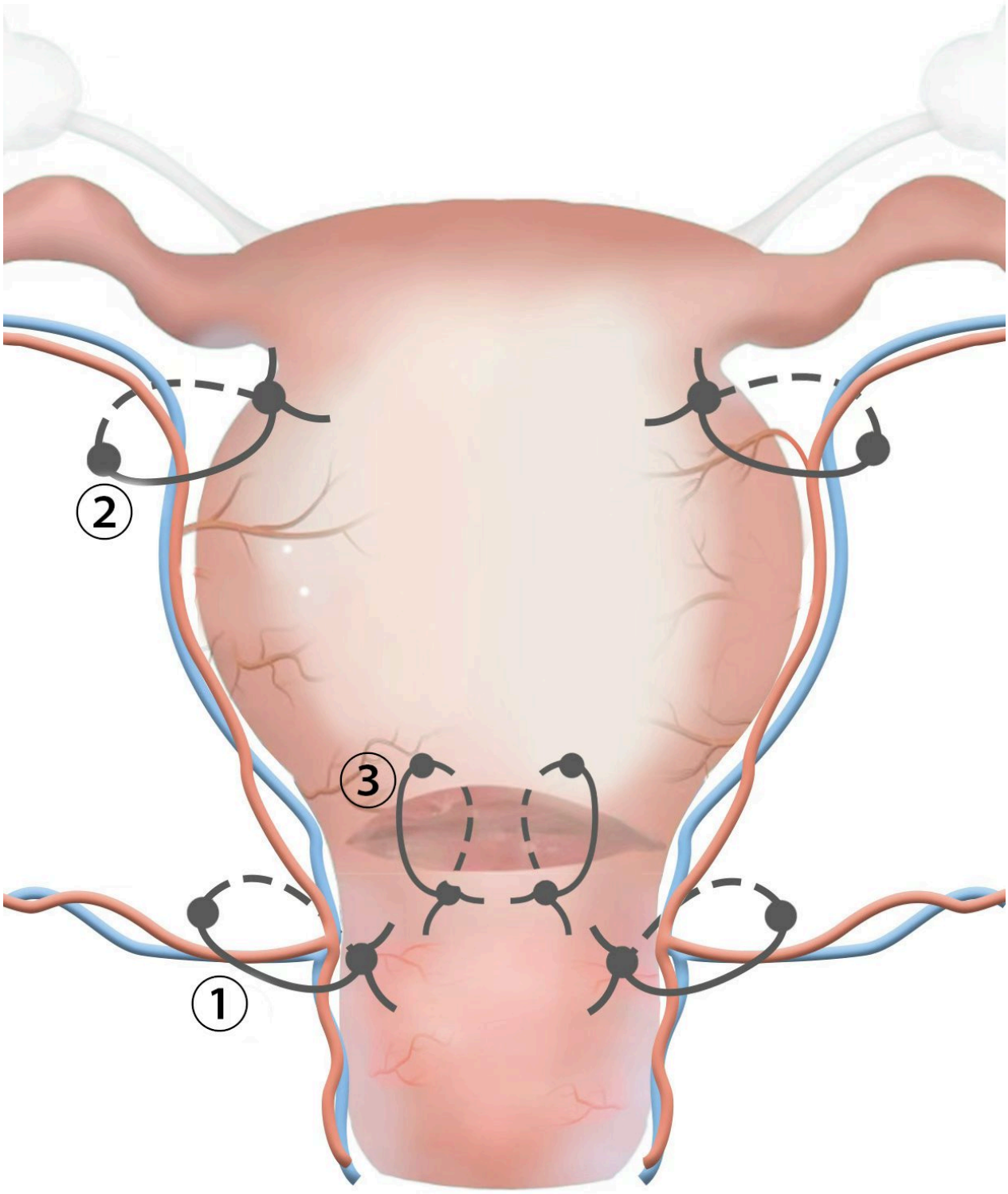


Figure 3

Key procedural steps of King’s Combined Uterine Suture Technique.

, Ligation of the uterine artery.

, Ligation of the utero-ovarian communicating branch

, Longitudinal suture of the lower uterine segment.

Supplementary Files

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