

Uterine artery ligation before placental delivery during caesarean in patients with placenta previa accreta

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Abstract

To investigate the influence of uterine artery ligation before placental delivery during cesarean section on postpartum hemorrhage (PPH) and related complications in patients with placenta previa accreta.

A retrospective study was conducted of data from 78 patients with pernicious placenta previa, treated at Fujian Provincial Maternal and Child Health Hospital (Fuzhou, China) between January 2014 and June 2018. Twenty-nine patients underwent uterine arterial ligation before placental delivery (UALBPD), and the other 49 patients in the control group did not undergo peri-paracentesis before the delivery of the placenta. The statistical analysis and data management were performed with SPSS 19.0.

The intraoperative and postoperative complications after uterine artery ligation were compared between the 2 groups: in the UALBPD group, no woman (0.0%) underwent a subtotal cesarean hysterectomy, whereas four (8.2%) did so in the control group ($P = .24$). The mean number of packed red blood cell (RBC) units transfused was 3.7 ± 1.2 in the UALBPD group and 5.7 ± 3.4 units in the control group ($P = .0002$). The estimated blood loss was 734.2 ± 317.5 mL in the UALBPD group and 1101.6 ± 442.7 mL in the control group ($P < .0001$). Nine (31.0%) women in the UALBPD group underwent transfusion compared with 38 (77.6%) in the control group ($P = .003$). The reduction in hemoglobin was 2.63 ± 1.85 g/L in the UALBPD group and 5.41 ± 2.38 g/L in the control group ($P < .0001$). The reduction in hematocrit was 2.96 ± 4.07 in the UALBPD group and 6.77 ± 8.74 (%) in the control group ($P = .009$).

Bilateral uterine artery ligation before the delivery of the placenta in women with placenta accreta can effectively reduce the amount of intraoperative blood loss, the incidence of PPH, and the risk of complications, such as hysterectomy.

Abbreviations: LUS = laparoscopic ultrasonography, MRI = magnetic resonance imaging, PPH = postpartum hemorrhage, UALBPD = uterine artery ligation before placental delivery.

Keywords: placenta Previa accreta, postpartum hemorrhage, uterine artery ligation before placental delivery

1. Introduction

An abnormally located placenta, covering the cervix, is known as placenta previa^[1] and is one of the most feared adverse maternal and fetal–neonatal complications in obstetrics. There seems to be an association between endometrial damage or uterine scarring and subsequent placenta previa. Moreover, the invasion of the

placental villi beyond the decidua basalis, causing placenta accreta or placenta increta, is a frequent complication.^[2] The incidence of placenta accreta has increased in recent decades in association with increasing rates of cesarean delivery, with a recent estimate of approximately 1 in 731 deliveries.^[3] Unexpectedly, placenta accreta can lead to dangerous conditions such as intractable postpartum hemorrhage (PPH), hysterectomy, multiple organ dysfunction, and even death.^[4] The preferred surgical approach to placenta accreta remains unclear, although most studies have shown improved outcomes with a planned cesarean hysterectomy before the onset of labor or bleeding.^[5]

The PPH caused by placenta accreta cannot be successfully stopped with prostaglandins, intrauterine tamponade,^[6] or transcatheter arterial embolization.^[7] During serious life-threatening PPH, it may be necessary to stop the bleeding in the shortest possible time. However, controlling this bleeding is complex and difficult. Although placenta accreta is increasing in frequency, few high-quality data are available to guide its management. Few randomized clinical trials have been conducted, and most information is derived from cohort studies, case series, and expert opinion.^[8] There is no uniform specification for the treatment of the PPH caused by placenta accreta.

Intractable bleeding can occur when placental abruption occurs in pernicious placenta previa. Reducing the loss of blood and preventing an emergency hysterectomy in patients with placenta accreta are extremely challenging. The preferred surgical approach to placenta accreta remains unclear, although most studies have shown improved outcomes when a planned cesarean

Editor: Sumaiya Adam.

This work was supported by the Fujian Provincial Maternity and Children's Hospital Science Foundation (FJSFY-17-12).

The authors have no conflicts of interests to disclose.

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How to cite this article: Lin J, Lin F, Zhang Y. Uterine artery ligation before placental delivery during caesarean in patients with placenta previa accreta. *Medicine* 2019;98:36(e16780).

Received: 23 November 2018 / Received in final form: 10 June 2019 /

Accepted: 18 July 2019

<http://dx.doi.org/10.1097/MD.00000000000016780>

hysterectomy is performed before the onset of labor or bleeding.^[5] However, hysterectomy is not the optimal approach. In cases without massive bleeding or coagulopathy, conservative approaches involving the use of uterine compression sutures or perfusion-reducing procedures may be considered.^[9] Therefore, the optimal method for reducing bleeding and preventing an emergency hysterectomy in mothers with placenta accreta warrants investigation.

In pregnancy, the uterine arteries contain 90% of the uterine blood supply and anastomose with the ovarian, fallopian, and vaginal arteries.^[10] Therefore, we ligate the uterine artery before placental abruption as a management strategy for PPH and hysterectomy in cases of placenta previa during caesarean deliveries. In this retrospective study, we evaluated the efficacy and safety of uterine artery ligation before placental abruption based on our experience in the treatment of placenta accreta.

2. Materials and methods

A retrospective study was conducted of data from 78 patients with pernicious placenta previa, treated at Fujian Provincial Maternal and Child Health Hospital (Fuzhou, China) between January 2014 and June 2018. All the data were collected and analyzed between January 1 and June 1, 2018.

The following criteria were met in this study. Each woman had a history of cesarean section, and at least 2 images confirmed total placenta previa, in which the placental tissue completely covered the internal cervical os after 20 weeks of gestation.^[8] Each woman had undergone a diagnostic evaluation by a practitioner with expertise in this condition and ultrasonography in the second and third trimesters, which can identify conditions on the placenta accreta spectrum with sensitivity and specificity of 80% to 90%.^[11] If trans-abdominal sonography was inconclusive, magnetic resonance imaging (MRI) was performed at 28 to 36 gestational weeks.^[12] No other surgical techniques, including external B-Lynch compression sutures or interventional methods, were used. All patients were followed up for 6 months by telephone. General data, information on surgical procedures, and intra-operative and postoperative records were obtained from the medical archives after approval was granted by the Ethics Committee of Fujian Provincial Maternal and Child Health Hospital. Lower uterus and bladder were fully separated, and than classical cesarean delivery was carried out in the lower uterine segment, all cases presented in this article were transverse incision. All cases presented in this article were elective cesarean section. The study was legally approved by our Institutional Ethics Committee, and the rights of all the participants were protected.

The condition of the placenta was diagnosed with trans-abdominal sonography or MRI, according to related references.^[13] For all patients with suspected placenta accreta or adherent placenta, the removed placental tissue was delivered to the Pathology Department of Fujian Provincial Maternal and Child Health Hospital. If the pathologists confirmed that villi were attached to the myometrium, the patient was diagnosed with placenta accreta. Vascular engorgement of the lower uterine segment and adhesion to the bladder or uterus were evaluated by at least 2 licensed obstetricians during the operation and the amount of blood lost was estimated by the number of wet surgical towels.

How to do the uterine ligation before placenta delivery. firstly, lifting the uterus outside the abdominal incision and the fingers in the uterine cavity the inner cervix is touched, and the inner mouth level is the lower point of the indicating point. In this area, the

uterine cervix of the 1 to 2 cm side of the cervix is transferred to the posterior needle through the Johnson 914 absorbable thread (with large needle). After the layer, the paratracheal vessels were jumped from the outside, and the needle was pulled from the posterior to the anterior area of the broad ligament and avascular zone. Then the pericardial blood vessels were tied and ligated.

Categorical variables are presented as frequencies. Continuous variables are presented as means \pm standard deviations. The associations between the study groups and categorical variables were examined with the χ^2 test. The Mann–Whitney–Wilcoxon test for independent samples was used for continuous variables. The relative risk and 95% confidence intervals are presented for binary outcomes. The statistical analysis and data management were performed with SPSS 19.0 (IBM, Armonk, NY). Statistical significance was defined as $P < .05$.

3. Results

In this study, we analyzed 78 patients with a diagnosis of placenta accreta between January 2014 and June 2018: 29 patients underwent uterine arterial ligation before placental delivery (UALBPD), and the other 49 patients in the control group did not undergo peri-paracentesis before the delivery of the placenta.

The clinical and histological characteristics of the 2 groups were similar (Table 1). All women in both groups had had a previous cesarean delivery, and ultrasonography showed that the lower edge of the placenta reached or covered the cervix in the third trimester. The intraoperative and postoperative complications after uterine artery ligation were compared between the 2 groups (Table 2): in the UALBPD group, no woman (0.0%) underwent a subtotal cesarean hysterectomy, whereas four (8.2%) did so in the control group ($P = .24$). The mean number of packed red blood cell (RBC) units transfused was 3.7 ± 1.2 in the UALBPD group and 5.7 ± 3.4 units in the control group ($P = .0002$). The estimated blood loss was 734.2 ± 317.5 mL in the UALBPD group and 1101.6 ± 442.7 mL in the control group ($P < .0001$). Nine (31.0%) women in the UALBPD group underwent transfusion compared with 38 (77.6%) in the control group ($P = .003$). The operation time was 1.23 ± 0.24 h in the UALBPD group and 1.55 ± 0.82 h in the control group ($P = .01$). There was no significant difference between the groups in terms of the number of days spent in hospital ($P = .07$).

Table 1
Clinical and histological characteristics between 2 groups.

Characteristics	UALBPD group (n = 29)	Control group (n = 49)	P value
Maternal age (yr)	28.7 \pm 7.7	29.3 \pm 6.9	$P = .73$
Gestational age at delivery (wk)	35.9 \pm 4.2	36.2 \pm 4.9	$P = .77$
Type of anesthetic			
Combined spinal-epidural anesthesia	29	45	$P = 2.24$
Combined spinal-epidural anesthesia and general anesthesia	0	4	$P = 2.24$
Measures to prevent hysterectomy			
Tamponade of the uterus	4	14	$P = .14$
B-Lynch procedure	15	26	$P = .91$
Bacri ballon	1	6	$P = .22$
Prior cesarean deliveries			
1	12	25	$P = .26$
2	12	19	$P = .94$
3	5	5	$P = .37$

UALBPD = uterine artery ligation before placental delivery.

Table 2

Maternal complications in patients with placenta accreta.

outcome	UALBPD group (n=29)	Control group (n=49)	P value
Transfusion rate (%)	9	38	P=.003
Amount of transfusion (packed RBC)	3.7±1.2	5.7±3.4	P=.0002
Estimated blood loss (mL)	734.2±317.5	1101.6±442.7	P<.0001
Operation time (h)	1.23±0.24	1.55±0.82	P=.01
Hospital days (d)	4.7±1.8	5.5±2.1	P=.07
Hysterectomy (%)	0	4	P=.24

UALBPD=uterine artery ligation before placental delivery.

In this study, we compared the preoperative and postoperative routine blood parameters and blood coagulation functions in the 2 groups. The reduction in hemoglobin was 2.63 ± 1.85 g/L in the UALBPD group and 5.41 ± 2.38 g/L in the control group ($P < .0001$). The reduction in the platelet count was 20.66 ± 20.75 in the UALBPD group and 40.71 ± 50.74 ($10^9/L$) in the control group ($P < .0001$). The reduction in hematocrit was 2.96 ± 4.07 in the UALBPD group and 6.77 ± 8.74 (%) in the control group ($P = .009$). There was no significant difference in the preoperative coagulation functions of the two groups ($P < .05$). The change in the coagulation function was significantly smaller in the UALBPD group than in the control group, and this difference, based on the reduction in fibrinogen, was significant ($P < .0001$).

4. Discussion

Placenta accreta is considered a severe complication of pregnancy and may be accompanied by substantial and potentially life-threatening peripartum hemorrhage.^[7] Previous cesarean section and placenta previa are the 2 main risk factors for its development.^[14] Placenta accreta is accompanied by many serious complications, the commonest of which are PPH, coagulopathy, and even hysterectomy.^[4] The conventional treatment is hysterectomy; however, in cases without massive bleeding or coagulopathy, a conservative approach can be considered.^[9] In pregnancy, the uterine arteries contain 90% of

the uterine blood supply. Bilateral uterine artery ligation significantly reduces the bleeding caused by uterine inertia and abnormal placentation. Therefore, based on the literature, we tested whether bilateral uterine artery ligation before placental delivery, which would directly reduce the flow in the arterial system, could control intraoperative and postoperative bleeding.

Identifying an effective method of hemostasis should improve the quality of life of the mother. In this study, we ligated the uterine artery before the delivery of the placenta, effectively reducing the amount of uterine bleeding and effectively stopping such bleeding before major changes occurred in the coagulation function. This reduced the operation time and simultaneously reduced the adverse outcomes for the mother. Verspyck et al^[15] reported the successful bilateral surgical devascularization of the uterus and ovary, which allowed five of six women with placenta accreta to retain their uteri. Ninety percent of the blood flow to the uterus during pregnancy is via the uterine arteries. Hemostasis was controlled in the UALBPD group by reducing the uterine blood flow, controlling the local arterial pressure, and accelerating thrombosis and uterine contraction. Consequently, the uterine blood flow was greatly reduced and the myometrium of the uterus was in a state of ischemia, which further stimulated the contraction of the uterus and thus applied pressure to the blood sinus, stopping the bleeding.

Our results also show that in the UALBPD group, no reduction in hemoglobin or change in coagulation function was observed

Table 3

Comparison with blood routine and blood coagulation function in 2 groups preoperative and postoperative.

Outcome	UALBPD group (n=29)	Control group (n=49)	P value
Hgb reduction (g/L)	2.63±1.85	5.41±2.38	P<.0001
Platelet counts reduction ($10^9/L$)	20.66±20.75	40.71±50.74	P<.0001
HCT reduction (%)	2.96±4.07	6.77±8.74	P=.009
Preoperative			
prothrombin time (s)	11.47±0.67	11.73±1.02	P=.17
international normalized ratio (INR)	0.98±0.04	0.98±0.09	P=.99
prothrombin activity (%)	102.12±8.82	106.93±15.12	P=.08
activated partial thromboplastin time (second)	27.24±2.91	28.98±4.41	P=.24
thrombin time (s)	17.09±2.73	15.57±2.93	P=.43
Fibrinogen (g/L)	3.88±1.06	4.03±0.92	P=.53
D- two dimer (mg/L)	3.09±2.81	2.64±3.01	P=.51
postoperative			
prothrombin time (s)	11.95±0.54	14.31±2.03	P<.0001
international normalized ratio (INR)	1.02±0.04	1.17±0.16	P<.0001
prothrombin activity (%)	93.61±10.59	74.29±20.37	P<.0001
activated partial thromboplastin time (second)	30.52±4.34	44.12±18.90	P<.0001
thrombin time (s)	14.54±5.11	27.33±23.75	P<.0001
fibrinogen (g/L)	3.36±0.77	1.68±1.08	P<.0001
D- two dimer (mg/L)	8.09±4.37	22.01±25.71	P<.0001

UALBPD=uterine artery ligation before placental delivery.

during the perioperative period. There has been increasing research interest in how the maternal coagulation profile changes during the course of major postpartum bleeding, and fibrinogen has been identified as an important factor that may influence the overall severity of blood loss.^[16] A number of important studies have provided evidence that substantiates the link between fibrinogen and PPH. Charbit et al published one of the earliest studies profiling the changes in the levels of fibrinogen and other coagulation factors during the course of PPH. They showed that fibrinogen was the only laboratory-tested parameter independently associated with severe PPH, and that the risk of severe PPH increased significantly for each 1g/L reduction in fibrinogen.^[17] De Lloyd et al observed that patients who received ≥ 4 units of RBC had a significantly lower nadir of fibrinogen than patients who received < 4 units of RBC (2.2g/L vs 3.8g/L, respectively; $P < .001$).^[18] Therefore, the change in coagulation function, especially the decline in fibrinogen, is an important cause of PPH, and blood transfusion is an important factor affecting the change in coagulation function. The uterine artery was ligated before the placenta was delivered, so the uterine blood supply was reduced and bleeding was reduced. The early control of blood loss precluded the development of dilutional coagulopathy and any further exacerbation of the reduced activity of coagulation factors, which permitted the easier formation of clots and reduced the amount of bleeding. When controlling PPH, it is necessary to control the bleeding early and to avoid any changes in the coagulation function. This has clinical significance in reducing PPH.

The main limitation of our study was its small sample size and that it was a retrospective study rather than a prospective study. Studies with larger samples are required before we can recommend the protocol we followed here for the standard management of patients similar to those we treated. Because the treatment of women with remnants of placenta accreta and PPH is critical and acute, studies with randomized designs are difficult. However, studies that compare our arterial ligation technique with other techniques, including stepwise devascularization, are possible, and must be undertaken.

5. Conclusion

Bilateral uterine artery ligation before the delivery of the placenta in women with placenta accreta can effectively reduce the amount of intraoperative blood loss, the incidence of PPH, and the risk of complications, such as hysterectomy.

Author contributions

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