Effect of Uterine Artery Clamping in Reducing Cesarean Hysterectomy in Pregnancies Complicated by Placenta Accrete Spectrum

Balen Mohammad Jabar*, **Maryam Bakir Mahmood**[**],
Taher Abdullah Hussein Hawramy[***], **Naz Azad Abdullah**[****]

Abstract

Background and objective: The placenta accreta spectrum is a major public health problem. Many interventional measures are used for controlling hemorrhage and preventing emergency caesarean hysterectomy. The aim of this study was to evaluate the role of uterine artery clamping in reducing maternal morbidity and mortality in pregnancies complicated by placenta accrete spectrum.

Methods: This is a retrospective case-control study implemented in the Sulaymaniyah Maternity Teaching Hospital in Sulaymaniyah city, Kurdistan region-Iraq through the period of 2 years from 1st of June 2020, to 31st of May, 2022. A sample of sixty pregnant women with placenta accreta spectrum surgically managed by elective cesarean section and divided into two study groups (32 women underwent elective cesarean section with uterine artery clamping [interventional group] and 28 women underwent elective cesarean section without uterine artery clamping [control group]).

Results: The postoperative hemoglobin level was significantly higher in women of the interventional group with a mean of (10.1±0.7 gm/dL) compared to (9.3±1 gm/dL) in women of the control group. The mean of units of blood transfused was significantly lower in women of the interventional group with a mean of (1.3±0.6 units) compared to (3.1±1.4 units) in women of the control group. Also, there was a significant reduction in units of fresh frozen plasma in women of the interventional group with a mean of (0.9±0.6 units) compared to (2.9±1.5 units) in women of the control group.

Conclusions: The uterine artery clamping before placental separation is helpful in reducing the rate of maternal morbidity and mortality in pregnancies complicated by placenta accreta spectrum.

Keywords: Emergency cesarean section,Placenta accreta spectrum,Uterine artery ligation.

*MBChB, KBMS/Obstetrics and Gynecology trainee; Sulaymaniyah Maternity Teaching Hospital-Sulaymaniyah-Kurdistan region/Iraq.

**MBChB, FICOG; Assistant Professor and Senior Lecturer in Obstetrics and Gynecology department at Medical college-Sulaymaniyah University-Kurdistan region/Iraq E-mail: Maryam.mahmmod@univsul.edu.iq
***MBChB, D.G.S, CABS, FACS, Consultant Surgeon, Sulaymaniyah-Kurdistan region/Iraq E-mail: hawramytahir@yahoo.com
****MBChB, CABOG, HDOG; Lecturer in Obstetrics and Gynecology department at Medical college-Sulaymaniyah University-Kurdistan region/Iraq   E-mail: naz.abdullah@univsul.edu.iq
*Corresponding author: Balen Mohammad Jabar.   E-mail: balenjabbar.mina@gmail.com

Introduction

The placenta accreta spectrum (PAS) is evolved nowadays to become one of the major iatrogenic public health concern.[1] The placenta accreta is defined as abnormally invaded trophoblast for part or all of the placenta deep into uterine wall through myometrium. The PAS or previously called morbidly adherent placenta is defined as range of disorders characterized by pathological placental adherence that included placenta increta, placenta precreta and placenta accrete.[2] Main reason for high PAS rates is an increased caesarean section rate. The PAS risk is ranged between 0.3% for one previous cesarean section and 6.7% for five or more cesarean sections. [3] Moreover, risk of PAS is reaching to about 11% when accompanied with placenta previa and one previous cesarean section, while it reaches about 40% with placenta previa and two previous cesarean sections, and about 60% if accompanied with placenta previa and three or more previous cesarean sections.[4] The favorable hypothesis regarding etiology of PAS revealed that abnormal placental villa anchoring and trophopblast infiltration in women with PAS is attributed to defective endometrial-myometrial interface in area of uterine scar that causing failure in developing normal deciduas. Many authors referred to history of previous caesarean sections that is associated with developing uterine scar which causing deficit in uterine wall and interrupted the endometrial-myometrial interface which increasing risk of placenta accreta spectrum.[5, 6] On other hand, this hypothesis failed to explain the etiology of placenta accreta spectrum disorders in women with nulliparous women or in women not subjected to previous uterine surgery and surgical intervention. [1, 7]

The PAS is accompanied with high rates of morbidity and mortality rates. Rate of co-morbidities associated with placenta accreta spectrum is ranged between 24-67% of affected women which are mainly severe bleeding with blood loss range of 2000-4000 ml, blood transfusion complications, coagulation disorders, organs injury, thromboembolic disorders, infection and second surgical operation.[8, 9] Maternal death rates related to placenta accreta spectrum are ranged between 0.05-7%, that are aggravated by many risk factors such as lack of early antenatal diagnosis, economic status, hospital facilities, multidisciplinary team and experience of surgeons.[10,11] Many societies and organizations emphasized specific guidelines regarding placenta accreta spectrum focusing on role of experienced multidisciplinary team and center of excellence in diagnosis and management of these disorders.[12-14]

The main factor that improves outcome and reduce maternal mortality and morbidity is an appropriate intervention at an appropriate time to stop bleeding in severe postpartum hemorrhage.[15]

Despite the high incidence of PAS recently, there is a scarcity in literatures discussing alternatives in management of this issue. The main goal in the management of placenta accreta spectrum is controlling blood loss and preventing an emergency hysterectomy. Many obstetricians prefer planned cesarean hysterectomy as it shows good outcomes in preventing hemorrhage and preserving lives.[16] However, hysterectomy is not the favorable choice especially in young women. The uterine arteries provide 90% of the uterine blood supply and anastomose with the ovarian, fallopian, and vaginal arteries.[17] For that reason; ligation of uterine artery before placental separation helps in controlling hemorrhage and preventing an emergent hysterectomy during cesarean sections for women with placenta accreta spectrum.[18]

In Iraq, the incidence of placenta accreta is increased in last decades with increased parity and previous cesarean sections number[19]. The cesarean section rates in Kurdistan region has increased in last years and has become higher than recommended rates by World Health Organization which explain the evolving increase in PAS incidence.[20] The aim of current study was to evaluate the role of uterine artery clamping in reducing the rate of maternal morbidity and mortality in pregnancies complicated by placenta accrete spectrum.

Patients and methods

The present study was a retrospective case control study conducted in the Sulaymaniyah Maternity Teaching Hospital in Sulaymaniyah city, Kurdistan region-Iraq through the period of 2 years from 1st of June 2020, to 31st of May, 2022.The studied population was pregnant women complicated by placenta accreta spectrum. Inclusion criteria were pregnant women with placenta accreta spectrum who have undergone elective cesarean section. Exclusion were unscheduled cesarean section and women with incomplete or missing saved data and women who refused to participate. The study ethics were implemented by documented approval of Kurdistan Board and Hospital authority, agreement of patients, in addition to confidentiality of data and management of complications accordingly. Sixty pregnant women with placenta accreta spectrum (PAS) surgically managed by elective cesarean section (CS) were taken and divided into two study groups (32 women underwent elective CS with uterine artery clamping [interventional group] and 28 women underwent elective CS without uterine artery clamping [control group]).
Information of pregnant women was collected either directly or retrospectively from saved records of women and filled in a prepared questionnaire designed by researchers. The questionnaire included women's general characteristics (age, residence, body mass index, gravidity, parity, miscarriage, and gestational age), women's medical and surgical history, previous cesarean sections and preoperative hemoglobin level) and surgery outcomes (postoperative hemoglobin level, blood and blood product transfusion, hysterectomy, other complications, hospital stay duration and surgical operation time). The diagnosis of placenta accreta spectrum was done by the obstetrician through at least two ultrasound reports showing signs of placenta accreta spectrum (loss of clear zone, placental lacunae, myometrial thinning, placental bulge, focal exophytic mass) while the final diagnosis was made during cesarean section. All cases were subjected to MDT (senior obstetricians,consultant surgeon in the presence of anastheologist and neonatologist) and cesarean section was decided by them. The cases were divided according to whether the uterine artery clamping was done or not. The cases were admitted in the Maternity Teaching Hospital one day before the operation, pre operatively all of them had prepared at least 4 units of blood and 4 units of fresh frozen plasma, cross matching was done. Counselling of the women was done about the consequences of the operation and the need for blood and blood product transfusion also the need for hysterectomy was discussed and written consent taken. The surgical procedure included delivery of the fetus and clamping of the umbilical cord, leaving the placenta insitu, then 10 IU oxytocin bolus and 10 IU infusion dose given the two vascular clamps were applied at the level of the internal os of cervix afterwards the placenta was delivered and the uterus was sutured by double layers, then the uterine artery clamps were removed. If the bleeding was severe and not controlled, other measures were undertaken such as bilateral Internal iliac artery ligation with or without

compression sutures. pre and post operative blood loss by hemoglobin level estimation with time of operation individually. The primary outcome measures were whether a caesarean hysterectomy was done or not, intraoperative blood loss, blood and blood products transfusion requirement, duration of surgery and the need for hemostatic measures.

The pregnant women's information was entered and interpreted statistically by SPSSprogram-26. Suitable table were implemented accordingly. The chi square and fishers' exact tests were used for statistical relationships, while independent sample t-test was used for continuous variables. A p value of ≤0.05 was regarded as significant.

Results

This study included sixty pregnant women with placenta accreta spectrum (PAS) surgically managed by cesarean section (CS) and divided into two study groups (32 women underwent CS with uterine artery clamping[interventional group] and 28 women underwent CS without uterine artery clamping [control group]).No significant differences were observed between women of both study groups regarding age (p=0.43), residence (p=0.6), BMI (p=0.48), gravidity (p=0.56), parity (p=0.28), miscarriage (p=0.64), dead baby (p=0.74) and gestational age (p=0.34). (Table 1)

Table (1): Distribution of women's general characteristics according to study groups.

Variable	Study groups				p value
	Interventional		Control		
	No.	%	No.	%	
Age (Years)					0.43 NS
20-29	2	6.3	4	14.3	
30-39	24	75.0	17	60.7	
≥40	6	18.8	7	25.0	
Residence					0.6 NS
Urban	12	37.5	8	28.6	
Rural	20	62.5	20	71.4	
BMI(Kg/m^2)					0.48 NS
Mean±SD	29.4±2.3		28.9±2.8		
Gravidity					0.56 NS

Mean±SD	4.6±1.6	4.8±1.8	
Parity			0.28 [NS]
Mean±SD	2.8±1.1	3.2±1.5	
Miscarriage			0.64 [NS]
Mean±SD	0.78±0.94	0.67±0.72	
Dead baby			0.74 [NS]
Mean±SD	0.21±0.55	0.17±0.39	
Gestational age (Weeks)			0.34 [NS]
Mean±SD	35.1±1.1	34.8±1	

NS=Not significant.

No significant differences were observed between women of both study groups regarding past medical history (p=0.57), past surgical history (p=0.66), previous cesarean sections number (p=0.8) and preoperative hemoglobin level (p=0.3). (Table 2)

Table (2): Distribution of women's medical and surgical history according to study groups.

Variable	Study groups				p value
	Interventional		Control		
	No.	%	No.	%	
Past medical history					0.57 [NS]
None	22	68.8	20	71.4	
DM	5	15.6	1	3.6	
HT	3	9.4	3	10.7	
Hypothyroidism	1	3.1	1	3.6	
DM & HT	1	3.1	2	7.1	
DM & Hypothyroidism	0	-	1	3.6	
Past surgical history					0.66 [NS]
CS	25	78.1	21	75.0	

CS & Appendectomy	4	12.5	2	7.1	
CS & laparotomy	1	3.1	2	7.1	
CS, Append. & laparotomy	1	3.1	1	3.6	
Cesarean section & curettage	0	-	1	3.6	
Previous CSs					0.8 [NS]
Mean±SD	2.6±1		2.7±1		
Preoperative Hb(g/dl)					0.3 [NS]
Mean±SD	11.5±0.9		11.2±1.3		

NS=Not significant.

The mean postoperative hemoglobin level was significantly higher in women of interventional group (p=0.002). Mean units of blood transfused was significantly higher in women of control group (p<0.001). Although no significant difference in hysterectomy between women of both study groups (p=0.057), women of interventional group were not subjected to hysterectomy, while three women of control group subjected to hysterectomy. No significant differences were observed between women of both study groups regarding other complications (p=0.16). A significant association was observed between longer hospital stay duration and women of control group (p<0.001). There was a significant association between increased units of fresh frozen plasma and women of control group (p<0.001). Mean surgical operation time was significantly longer in women of control group (p<0.001). (Table 3)

Table (3): Distribution of surgery outcomes according to study groups.

Variable	Study groups				p value
	Interventional		Control		
	No.	%	No.	%	
Postoperative Hb(g/dl)					0.002[S]
Mean±SD	10.1±0.7		9.3±1		
Blood transfusion(units)					<0.001[S]
Mean±SD	1.3±0.6		3.1±1.4		
Hysterectomy					0.057 [NS]
Yes	0	-	3	10.7	
No	32	100.0	25	89.3	

Other complications					0.16 [NS]
None	29	90.6	19	67.9	
PPH	0	-	3	10.7	
Bladder injury	1	3.1	3	10.7	
RPOC	1	3.1	1	3.6	
Secondary laparotomy	0	-	1	3.6	
Bladder injury &Rectovaginal fistula	1	3.1	0	-	
PPH & PROC	0	-	1	3.6	
Hospital stay duration(days)					<0.001 [S]
Mean±SD	2±0.4		2.7±0.6		
Fresh frozen plasma(units)					<0.001 [S]
Mean±SD	0.9±0.6		2.9±1.5		
Operation time(minutes)					<0.001 [S]
Mean±SD	78.2±15.4		111.4±23.9		

S=Significant, NS=Not significant.

Discussion

The placenta accreta spectrum is an unfortunate life-threatening obstetrical complication. Globally, the trend of PAS has increased in last decades due to high increase of cesarean section rates.[21]

The present study showed that mean postoperative hemoglobin level was significantly higher in intervention group compared to control group (p=0.002). This finding is consistent with results of Lin et al[18] retrospective study in Iraq which revealed that mean reduction of hemoglobin among PAS women in which the uterine artery was ligated before placental delivery, was (2.63 g/L), while the mean reduction of hemoglobin among PAS women in which the uterine artery was not ligated, was (5.41 g/L). Our study also reported a significantly lower mean units of blood transfused for PAS women who have undergone cesarean section with uterine artery clamping (p<0.001). This finding coincides with results of El Gelany et al [22] prospective study in Egypt which reported that estimated blood loss and blood transfusion units were significantly lower in PAS women managed by uterine artery ligation. Another case series study conducted in USA by Turan et al [23] revealed a higher estimated blood loss levels among women with PAS managed surgically by cesarean section without uterine artery clamping. In Iraq, it was shown that PAS complicating pregnancies were highly associated with blood loss and needed at least four to five pints of blood during management.[24]

The current study found no significant difference in hysterectomy rate between the two groups (p=0.057). This finding is similar to results of Mohr-Sasson et al [25] who

reported a comparable hysterectomy rate among women with PAS managed with uterine artery clamping and those women managed without uterine artery clamping. However, our study showed that PAS women with uterine artery clamping were not subjected to hysterectomy, while three PAS women with uterine artery clamping were subjected to hysterectomy. These findings are in agreement with results of Aryananda et al [26] which stated that cesarean hysterectomy could not be the default treatment option for pregnant women complicated by placenta accreta spectrum and other treatment options showed a higher efficacy and safety without need for hysterectomy. Our study also found no significant differences between women of both study groups regarding other complications like PPH, bladder injury, etc. These findings are consistent with results of Verit et al [27] and Liu et al [28] which all revealed no significant effect of uterine artery clamping in reducing such complications.

In present study, a significant association was observed between longer hospital stay duration and women of control group (p<0.001). Consistently, Kale et al[29] reported that uterine artery ligation decreases the duration of hospital stay of women. Our study found a significant association between increased units of fresh frozen plasma and women of control group (p<0.001). This finding is parallel to reports of Butwick et al [30] who documented that fresh frozen plasma is highly needed for women with placenta accreta spectrum especially if managed without clamping of uterine artery. The current study also revealed that mean surgical operation time was significantly longer in women of control group (p<0.001). This finding is similar to results of Verspyck et al [31] who revealed a shorter surgical operation time for PAS women subjected to uterine artery clamping.

Conclusion:
This study concluded that uterine artery clamping before placental separation is helpful in reducing the rate of maternal morbidity and mortality in pregnancies complicated by placenta accreta spectrum and in reducing anemia, blood and blood product transfusion, surgical operation time and hospital stay duration.

Recommendation:
This study encourages Obstetricians to adopt the option of uterine artery clamping in surgical management of placenta accreta spectrum. Further multi-centers studies on role of uterine artery clamping in management of placenta accreta spectrum should be supported.

Conflicts of interest
None

References
1. Mogos MF, Salemi JL, Ashley M, et al. Recent trends in placenta accreta in the United States and its impact on maternal-fetal morbidity and healthcare-associated costs, 1998-2011. J Matern Fetal Neonatal Med 2016; 29:1077–82.
2. Cahill AG, Beigi R, Heine RP, Silver et al. Society of Gynecologic Oncology; American College of Obstetricians and Gynecologists and the Society for Maternal–Fetal Medicine. Am J Obstet Gynecol. 2018; 219(6): B2-B16.
3. Marshall NE, Fu R, Guise J-M. Impact of multiple cesarean deliveries on maternal morbidity: a systematic review. Am J Obstet Gynecol 2011; 205: 262.e1–262.e8.

4. Özcan S, Karayalçın R, Kanat P et al. Multiple repeat cesarean delivery is associated with increased maternal morbidity irrespective of placenta accreata. Eur Rev Med Pharmacol Sci 2015; 19(11):1959-63.

5. JauniauxE, CollinsS, Burton GJ. Placenta accreta spectrum: pathophysiology and evidence-based anatomy for prenatal ultrasound imaging. 2018; 218(1):75-87.

6. Bartels HC, Postle JD, Downey P, Brennan DJ. Placenta Accreta Spectrum: A Review of Pathology, Molecular Biology, and Biomarkers. Dis Markers 2018; 2018:1507674.

7. Touhami O, Allen L, Flores Mendoza H, Murphy MA, Hobson SR. Placenta accreta spectrum: a non-oncologic challenge for gynecologic oncologists. Int J Gynecol Cancer 2022; 32:788– 98.

8. Eller AG, Bennett MA, Sharshiner M, et al. Maternal morbidity in cases of placenta accreta managed by a multidisciplinary care team compared with standard obstetric care. Obstet Gynecol 2011; 117:331–7.

9. Hoffman MS, Karlnoski RA, Mangar D, et al. Morbidity associated with nonemergent hysterectomy for placenta accreta. Am J Obstet Gynecol 2010; 202: 628.e1–628.e5.

10. Jauniaux E, Bunce C, Grønbeck L, Langhoff-Roos J. Prevalence and main outcomes of placenta accreta spectrum: a systematic review and meta-analysis. Am J ObstetGynecol 2019; 221:208–218.

11. Nieto-Calvache AJ, Palacios-Jaraquemada JM, Osanan G et al. Lack of experience is a main cause of maternal death in placenta accreta spectrum patients. Acta ObstetGynecolScand 2021; 100:1445–53.

12. Allen L, Jauniaux E, Hobson S, Papillon-Smith J, Belfort MA. Placenta Accreta Diagnosis and Management Expert Consensus Panel. FIGO consensus guidelines on placenta accreta spectrum disorders: nonconservative surgical management. Int J Gynaecol Obstet 2018; 140:281–90.

13. Cahill AG, Beigi R, Heine RP. Obstetric Care Consensus No. 7 Summary: placenta accreta spectrum. Obstet Gynecol 2018; 132:1519–21.

14. Hobson SR, Kingdom JC, Murji A, et al. No. 383-Screening, diagnosis, and management of placenta accreta spectrum disorders. J Obstet Gynaecol Can 2019; 41:1035–49.

15. Salim R, Chulski A, Romano S. Precesarean prophylactic balloon catheters for suspected placenta accreta. Obstet Gynecol 2015; 126:1022–28.

16. Meller CH, Izbizky GH, Otano L. Outcomes of planned compared with urgent deliveries using a multidisciplinary team approach for morbidly adherent placenta. Obstet Gynecol 2018; 131:1164–5.

17. Søvik E, Stokkeland P, Storm BS. The use of aortic occlusion balloon catheter without fluoroscopy for life-threatening post-partum haemorrhage. Acta Anaesthesiol Scand 2012; 56:388.

18. Lin J, Lin F, Zhang Y. Uterine artery ligation before placental delivery during caesarean in patients with placenta previa accreta. Medicine (Baltimore) 2019; 98(36): e16780.

19. Showman HA, Alizzi FJ, Helmi ZR, Ismael VA, Fawzi HA. Placenta accrete spectrum disorders: A single centre experience over four years in the view of international guidelines. J

Pak Med Assoc 2019; 69(Suppl 3) (8): S68-S72.

20. Ahmed HM, Ghanim NA. Rate and indications of cesarean section in the Maternity Teaching Hospital in Erbil City, Kurdistan region, Iraq. Zanco J Med Sci. 2018; 22(2): 148–54. Available from: https://doi.org/10.15218/zjms.2018.020

21. Pegu B, Thiagaraju C, Nayak D, Subbaiah M. Placenta accreta spectrum-a catastrophic situation in obstetrics. Obstet Gynecol Sci 2021; 64(3):239-47.

22. El Gelany S, Mosbeh MH, Ibrahim EM, et al. Placenta Accreta Spectrum (PAS) disorders: incidence, risk factors and outcomes of different management strategies in a tertiary referral hospital in Minia, Egypt: a prospective study. BMC Pregnancy Childbirth 2019; 19(1):313.

23. Turanv OM, Shannonv A, Asogluv MR, Goetzinger KR. A novel approach to reduce blood loss in patients with placenta accreta spectrum disorder. J Matern Fetal Neonatal Med 2021; 34(13):2061-70.

24. Abdulla N, Ghafel DH. Placental complications among Iraqi Pregnant Women with Placenta Accreta. Kufa Journal for Nursing Sciences 2021; 11(1): 1–8. Available from: https://journal.uokufa.edu.iq/index.php/kjns/article/view

25. Mohr-Sasson A, Hochman R, Anteby M, the management of placenta accreta spectrum disorder—A comparative study. Acta Obstet Gynecol Scand 2020; 99:1374–80. Available from: https://doi.org/10.1111/aogs.13868

26. Aryananda RA, Aditiawarman A, Gumilar KE. Uterine conservative–

resective surgery for selected placenta accreta spectrum cases: Surgical–vascular control methods. Acta Obstet Gynecol Scand 2022; 101:639–48.

27. Verit FF, Çetin O, Keskin S, Akyol H, Zebitay AG. Does bilateral uterine artery ligation have negative effects on ovarian reserve markers and ovarian artery blood flow in women with postpartum hemorrhage? Clin Exp Reprod Med 2019; 46(1):30-5.

28. Liu W, Yin W. Effect of Uterine Artery Ligation and Uterine Artery Embolization on Postpartum Hemorrhage Due to Uterine Asthenia after Cesarean Section and Its Effect on Blood Flow and Function of Uterine and Ovarian Arteries. J Healthc Eng 2022; 2022:1337234.

29. Kale A, Aksu S, Terzi H, Demirayak G, Turkay U, Sendag F. Uterine artery ligation at the beginning of total laparoscopic hysterectomy reduces total blood loss and operation duration. J Obstet Gynaecol 2015; 35(6):612-5.

30. Butwick AJ, Goodnough LT. Transfusion and coagulation management in major obstetric hemorrhage. Curr Opin Anaesthesiol 2015; 28(3):275-84.

31. Verspyck E, Resch B, Sergent F, Marpeau L. Surgical uterine devascularization for placenta accreta: immediate and long-term follow-up. Acta Obstet Gynecol Scand 2005; 84(5):444-7.