

Validity of Internal Iliac Artery Ligation with Cervico-Isthmic Compression Suture During Conservative Management of Placenta Accreta Spectrum

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ABSTRACT

Background: Placenta accreta is becoming a common complication of pregnancy. Hysterectomy has been considered the best therapeutic modality in the context of it, but this represents a problem for patients desiring to preserve the uterus for future fertility. Surgical internal iliac artery ligation (IIAL) is usually utilized to attempt to control obstetric hemorrhage. Ligation of the internal iliac arteries has restricted effectiveness. Either ligation of the anterior division of the internal iliac or uterine artery is often employed in a trial to control postpartum hemorrhage (PPH) before resorting to hysterectomy.

Objective: To assess the efficacy of IIAL before bladder dissection during conservative management of cases of the morbidly adherent placenta (MAP) using a cervico-isthmic compression suture.

Patients and methods: This randomized control study comprised 42 patients with placenta previa (major and minor); divided into two groups; group A (21 patients with bilateral ligation of IIA) and group B (21 patients without ligation of IIA).

Results: The amount of blood loss in group A was more than in group B. There was a statistically significantly higher number of packed RBCs transfused units, total estimated blood loss (liters) in group A vs group B. The rate of hysterectomy was statistically higher among group A than Group B.

Conclusion: This study demonstrated that bilateral IIAL, as an intervention to reduce blood loss during conservative management for AIP using cervico-isthmic compression suture (CIC), is not beneficial.

Keywords: Abnormally invasive placenta, Placenta accreta spectrum, Postpartum hemorrhage, Loss retroplacental hypoechoic zone.

INTRODUCTION

The incidence of placenta accrete increta and percreta, collectively called placenta accreta spectrum (PAS) disorders, has been rising considerably over the last decade globally, mostly owing to arising cesarean delivery (CD) rate accompanied by a lot of adverse events comprising extensive blood transfusion, disseminated intravascular coagulopathy (DIC), high morbimortality rates as antepartum and PPH, nearby pelvic organs injury, infections and psychological sequel owing to the loss of femininity and fertility⁽¹⁾.

There are methods to manage PAS such as cesarean hysterectomy (CS hysterectomy) and conservative treatment which includes a stepwise approach, cervico isthmic compression suture, and Triple-P procedure⁽²⁾. Vessels' ligation could be utilized as a part of traditional management concerning PAS management to reduce blood loss as uterine artery ligation (UAL) and IIAL. Surgical ligation of the anterior divisions of the IIA is practiced by a lot of tertiary care centers throughout the management of women with PAS disorders⁽³⁾. On the other hand, there is no recommendation for the traditional usage of IIAL before bladder dissection during conservative management of PAS. The retroperitoneal space was dissected and bifurcation of common iliac vessels was recognized, following identification of the ureter, the IIA was dissected on both sides away from nearby tissues and iliac vein⁽⁴⁾.

Placenta accrete spectrum (PAS) could be described as pathologic invasion of the placental trophoblasts to the myometrium and beyond with

subtypes defined as accreta (adhere to the myometrium), increta (invade deep to the myometrium) and percreta (reach to the uterine serosa and beyond)⁽³⁾.

Strategies of traditional management of placenta accreta with promising outcomes have been employed to evade peripartum hysterectomy and preserve fertility. These approaches might be appropriate as long as the bleeding is still mild. The key to the success of non-surgical intervention rests mainly on early diagnosis or, more precisely, on early suspicion of placenta accreta. The primary components of efficient conservative non-surgical management are leaving the placenta undisturbed, interval placental removal, and different plans⁽⁵⁾. Hence, the current study was done to evaluate the efficacy of IIA suture ligation before bladder dissection through traditional management with cervico-isthmic compression suture in patients of morbidity adherent placenta.

PATIENTS AND METHODS

Study design

This was a randomized control study that had been carried out at the Obstetrics and Gynecology Department, Mansoura University Hospitals, through the period from September 2020 to September 2021 after obtaining approval from the Local Ethics Committee of Mansoura Faculty of Medicine.

The study included 42 pregnant women. The comprised cases were divided into two groups in a random manner (Group A: with IIAL:21 patients) and (Group B without IIAL:21 patients) with the use of opaque sealed unlabeled envelopes, each containing a

specific study number. All of the surgical procedures were carried out by the same surgeon to minimize variation in the results due to differences in surgeon experience.

The study included pregnant females aged from 20 to 35 years with a history of 3 cesarean deliveries or less, also, the study included pregnant females without complicated medical disorders such as hypertension, pre-eclampsia, diabetes mellitus, and rheumatic heart disease. Pregnant females with two or more forms of the criteria presented by transabdominal ultrasound and color Doppler were included in this study. Also, female patients with placenta increta or percreta which diagnosed by FIGO classification (2019) as follow ⁽⁶⁾.

Grade II (FIGO 2019): Abnormally invasive placenta (increta) clinical criteria ⁽⁶⁾:

At laparotomy: Abnormal macroscopic findings over the placental bed; bluish, purple coloring, distension (placental "pulge"). Significant amounts of hypervascularity (dense tangled bed of vessels or multiple vessels running parallel craniocaudal in the uterine serosa). No placental tissue was seen to be invading the uterine serosa. Gentle cord traction results in the uterus being pulled inwards without separation of the placenta (so-called dimple sign).

Grade III (FIGO 2019): Abnormally invasive placenta (percreta) clinical criteria ⁽⁶⁾:

Grade 3a: Limited to the uterine serosa.

At laparotomy:

Abnormal macroscopic findings on the uterine serosal surface (as above) and placental tissue seen to be invading through the surface of the uterus. No invasion into any other organ, including the posterior wall of the bladder (a clear surgical plane can be identified between the bladder and uterus).

This study excluded pregnant female cases aged more than 35 years with a history of 3 or more cesarean deliveries, female patients who refused traditional treatment, and female patients who had uncontrolled diabetes mellitus, hypertension, pre-eclampsia, and rheumatic heart disease (decompensated). Pregnant females with placenta accreta classified Grade I according to FIGO 2019 was also excluded.

Methods:

All women were subjected to counseling and written consent was obtained from them and their husbands following informing them about the possibility of intrapartum and PPH, the necessity for blood transfusion, and the likelihood of hysterectomy if required to manage extensive blood loss. They were also subjected to complete history taking including maternal age, parity, methods of delivery, maternal past history and diseases accompanied by pregnancy, and clinical examination by an ultrasound scan and abnormal adhesion of the placenta was verified by color flow Doppler in the third trimester of pregnancy.

Also, routine assessment of all patients and fetuses was conducted based on the unit's policy by assessment of physical examination, and investigations comprising CBC, coagulation profile, and organ functions.

The patient data were checked for the confirmation of the diagnosis of placenta accreta as; a histopathological diagnosis that was done by biopsy taken from the placental bed or hysterectomy, abnormally adherent placenta, needing active management, and females who have had a manual placental excision with moderate difficulty but needed no further management were excluded. Also, the women's risk factors for placental accreta were rechecked by radiology to determine the site of the placenta and its relation to the previous uterine scar.

Operative Technique:

A multidisciplinary team comprising a senior obstetrician and assistant, a urologist, an anesthetist, and a pediatrician was concerned with the operation. Four units of cross-matched blood were prepared for each patient. After general anesthesia, a suprapubic incision was performed through the opening of the abdominal wall layers. A high uterine incision is performed avoiding the placenta, delivery of the baby, and leaving the placenta in situ. In group A; bilateral IAL was done, then bladder dissection, after UAL was performed on both sides after that cervico-isthmic compression suture was undertaken but in group B; bladder dissection was done, then bilateral UAL, after that cervico-isthmic compression suture was performed. Finally, for both groups, the closure of the abdominal wall was done.

Confirmation of Placental Invasion:

Placenta accreta was confirmed either at the cesarean section on a clinical basis (difficult placental excision or existence of visual invasion of the placenta into the uterine wall, serosa, or nearby tissues) or histopathologic on hysterectomy specimen or myometrium specimen when feasible.

Outcome Measurements:

Primary Outcome: The estimation of blood loss was based on pictorial strategies to enhance the visual measurement of blood loss at obstetric hemorrhage ⁽⁷⁾. It was evaluated by; towels weighing dry and soaked before and after surgery, the volume of blood in the suction apparatus, Hb and Hct pre and postoperative, and the number of packed RBCs transfused units.

Secondary Outcomes: It was evaluated by operative time (starting from uterine incision till the closure of uterine incision), rate of hysterectomy, and postoperative complications (PPH, fever, wound sepsis, urologic injury, vascular injury and ICU admission, etc.).

Ethical consent:

This study was ethically approved by the Institutional Review Board of the Faculty of Medicine, Mansoura University, Written informed consent was taken from all participants. The study was conducted according to the Declaration of Helsinki.

Statistical analysis

SPSS statistics for windows version 26 (IBM, Armonk, NY, USA) were utilized. The Shapiro-Wilk test was utilized to assess the normal distribution of the data. Entire tests were carried out with 95% CI. P (probability) <0.05 was considered statistically significant. Quantitative variables were expressed as mean and SD whereas categorical variables were expressed as frequency and percentage. Independent sample T (as regards parametric continuous data) and

Mann-Whitney tests (as regards non-parametric continuous data) were utilized for inter-group comparison. Fisher exact and Chi-square tests were utilized for inter-group comparison of nominal data by utilizing the cross-tabs function.

RESULTS

This study involved 42 cases divided into two groups; group A included 21 patients (with Bilateral ligation of IIA), one of these cases had previous CS at MUH, while all other 20 cases were in private hospitals and group B included 21 patients (without ligation of IIA), all of those 21 cases had previous CS in private hospitals. There was statistically significantly higher gravidity in group A vs. group B, but there was no significant difference as regards other data (age, BMI, parity, and gestational age) (**Table 1**).

Table (1): Demographic data of the studied groups

Characteristic	Group A (with Bilateral IIAL) N=21	Group B (without IIAL) N=21	Test of significance	
Age (years)	29. 8 ± 3. 6	28. 1 ± 4	1. 489	0. 144
BMI (kg/m ²)	31. 4 ± 4. 4	31 ± 4	0. 294	0. 770
Gravidity	4 (3. 5 – 6. 5)	4 (3 – 4)	-2. 183	0. 029
Parity	2 (2 – 3)	2 (2 – 3)	-0. 436	0. 663
Gestational age (weeks) at delivery	35(34 – 35)	35 (34 – 35)	-1. 109	0. 267

Quantitative data are mean ± SD for age, BMI (Independent-Samples t-test), and median (Q1 – Q3) for gravidity, parity, and gestational age (Mann-Whitney U-test).

Regarding ultrasonographic signs and Doppler study of the placenta of the two studied groups, there was a statistically significantly higher placental lacuna, bladder wall interruption, placental bulge, sub-placental hypervascularity, and bridging vessels in group A vs. group B. There was no significant difference regarding other TAS and Doppler study data (focal exophytic mass and ureterovesical hypervascularity). TAS and Doppler study shows loss of clear zone and myometrial thickness <1 mm in all 21 cases in both groups (**Table 2**).

Table (2): Ultrasonographic signs and Doppler study of the placenta of the studied groups

Characteristic	Group A (with Bilateral IIAL) N=21	Group B (without IIAL) N=21	Test of significance	
Loss of clear zone	21 (100%)	21 (100%)	FET	1. 000
Myometrial thinning	21 (100%)	21 (100%)	FET	1. 000
Placental lacunae	5 (3 – 5. 5)	1 (1 – 2. 5)	-3. 951	<0. 001
Focal exophytic mass	0 (0%)	1 (4. 8%)	FET	1. 000
Bladder wall interruption	14 (66. 7%)	0 (0%)	FET	<0. 001
Placental bulge	11 (52. 4%)	2 (9. 5%)	9. 024	0. 003
Utero-vesical hypervascularity	6 (28. 6%)	2 (9. 5%)	FET	0. 238
Sub-placental hypervascularity	7 (33. 3%)	0 (0%)	FET	0. 009
Bridging vessels	5 (23. 8%)	0 (0%)	FET	0. 048

Quantitative data are median (Q1 – Q3) for placental lacunae (Mann-Whitney U-test). Categorical data is N (%), and Chi-square test for the placental bulge, and Fisher’s exact test (FET) for others.

Regarding the FIGO stage at laparotomy, there was a statistically significantly higher stage II in group B and stage IIIa in group A as shown in Table (3). While regarding histopathological FIGO Staging there was a statistically significant higher non-satisfying biopsy in group B vs. group A and statistically significant higher stages II & IIIa in group A vs. group B.

Table (3): Laparotomy and histopathological FIGO staging

FIGO stage		Group A (with Bilateral IIAL)	Group B (without IIAL)	P-value
laparotomy	Stage II	5 (23. 8%)	19 (90. 5%)	<0. 001
	Stage IIIa	16 (76. 2%)	2(9. 5%)	
Histopathological	I	3 (14. 3%)	1 (4. 8%)	<0. 001
	II	10 (47. 6%)	0 (0%)	
	IIIa	6 (28. 6%)	0 (0%)	
	Non-satisfying	2 (9. 5%)	20 (95. 2%)	

Data are N (%).Chi-Square test.

Regarding FIGO staging at laparotomy and histopathological examination of biopsies of the studied patients, there was a statistically significant difference between FIGO staging at laparotomy and histopathology (P = 0. 001). Post-hoc 2 X 2 Fisher’s exact tests showed that non-satisfying biopsy was statistically significantly higher in laparotomy stage II than stage IIIa, and all 6 stage IIIa cases by histopathology were also diagnosed as stage IIIa at laparotomy (Table 4).

Table (4): FIGO staging at laparotomy and histopathological examination of biopsies of the studied patients.

Histopathological stage	FIGO stage at laparotomy		P-value
	Stage II N=24	Stage IIIa N=18	
Non-satisfying biopsy	18 (75%)	4 (22. 2%)	0. 001
Stage I	2 (8. 3%)	2 (11. 1%)	
Stage II	4 (16. 7%)	6 (33. 3%)	
Stage IIIa	0 (0%)	6 (33. 3%)	

Data are N (%). Fisher’s exact test.

Regarding the perioperative assessment of blood loss, there was a statistically significantly higher number of packed RBCs transfused units, and total estimated blood loss (liters) in group A vs. group B (Table 5). Regarding the outcomes of this study, the success rate of conservative treatment was 71.4% in group A and 90.5% in group B. However, this difference didn’t achieve statistical significance (P= > 0. 05). There was a statistically significant difference in the occurrence of postoperative complications in the form of bladder injury between the two groups. In group A, 3 cases were complicated vs. one in group B. None of the cases developed vascular or neurologic complications (Table 6).

Table (5): Perioperative assessment of blood loss

	Group A (with Bilateral IIAL) N=21	Group B (without IIAL) N=21	P-value
Number of Packed RBCs transfused units	4 (3 – 6. 5)	2 (2 – 3)	0. 001
Total estimated blood loss (L)	3.3 ± 0.82	1. 76 ± 0.3	0. 009
Preoperative hemoglobin	10. 6 ± 0. 7	11. 2 ± 0. 8	0. 018
Postoperative hemoglobin	10. 6 ± 1. 2	11. 3 ± 1. 0	0. 095
Preoperative Hematocrit	33. 5 ± 2. 3	33. 3 ± 2. 5	0. 864
Postoperative hematocrit	31. 3 ± 4. 4	32. 9 ± 1. 2	0. 142

Data are median (Q1 – Q3) and Mann-Whitney U-test or mean ± SD and the test of significance is the independent-samples t-test

Table (6): Outcomes of conservative treatment.

Outcomes		Group A (Group with IIAL) N=21	Group B (Group without IIAL) N=21	P-value
Success	Successful cases	15 (71.4%)	19 (90.5%)	0.238
	Failed cases (hysterectomy)	6 (28.6%)	2 (9.5%)	
Complications	Bladder injury	3 (14.3%)	1 (4.8%)	0.606 (FET)
	Vascular	0 (0%)	0 (0%)	
	Neurological	0 (0%)	0 (0%)	

Data are N (%). Chi-Square test or Fisher’s exact test (FET).

DISCUSSION

Placenta accreta represents a nightmare complication of pregnancy. MAP incidence has increased by about 10 folds over the last 50 years. Its incidence has increased as high as reported 1:533 in USA and 1:588 in Canada (8). The incidence of placental invasion is increasing owing to the increase in the frequency of CD (9). It has been demonstrated that 93% of patients with recorded placenta accreta had undergone previous one or more cesarean sections (10, 11). Prenatal identification of placenta accreta is of great importance to control optimum delivery situations for such women. Another advantage of prenatal identification is to plan the delivery in an appropriate center with a multidisciplinary team and proper equipment and resources comprising a maternity-oriented ICU, an embolization unit with interventional radiologists, a blood bank able to manage massive transfusion needs, and the availability of different skills as urologists and vascular surgeons (12).

Hysterectomy has been considered the best therapeutic modality in the context of placenta accreta, however, this represents a problem for cases desiring to preserve the uterus for future fertility as a result, other therapeutic modalities involve leaving the placenta following CD with uterine devascularization, uterine artery embolization (UAE) and uterine compression sutures (13).

Various approaches were designed to reduce intraoperative bleeding based on decreasing pelvic circulation, mainly of the internal iliac arteries for disturbance of the uterine arterial blood supply with subsequent preservation of the blood supply to different pelvic structures. This could be achieved by temporary balloon occlusion or by intraoperative IIAL (14).

IIAL has a variable efficiency rate (ranging from 40% to 100%) (15). Immediately following occlusion, a network of collateral circulations is established, comprising the lumbar, iliolumbar, middle and lateral sacral, and middle and superior rectal arteries (16).

In this study, in an attempt to assess the efficacy of IIA suture ligation before bladder dissection throughout traditional management of cases of MAP using cervico-isthmic compression suture; we enrolled 42 patients with placenta previa (major and minor); divided into two groups; group A that included 21

patients, group B that included also 21 patients. Our data highlighted statistically significant higher gravidity in group A versus group B. But there was no significant difference as regards all other data (age, BMI, parity, and gestational age). In our study, the degree of blood loss in group A was more than in group B. There was a statistically significantly greater number of packed RBCs transfused units, total estimated blood loss (liters) in group A vs group B.

In the same line, *Levine et al.* (17) have demonstrated that performing presurgical balloon occlusion of the pelvic artery in cases diagnosed with placenta accrete, before undergoing cesarean hysterectomy didn’t enhance the outcome in the 5 included cases. In addition, another study revealed that IIAL didn’t decrease morbidity, measured blood loss, or the requirement for a huge amount of blood transfusion between antenatally diagnosed cases of AIP and reported that prophylactic ligation in cases of AIP isn’t suggested (18, 19). This could be related to the fact that divisions of the external iliac artery could still supply the paravesical and vaginal regions following IIAL, which would clarify the failure of IIAL in managing blood loss in AIP (20).

Similarly, in a randomized controlled trial conducted by *Hussein et al.* (4) 57 pregnant females with ultrasound features indicative of AIP were comprised. They were divided into 2 groups; the IIA group carried out bilateral IIA ligation followed by cesarean hysterectomies, whereas the control group underwent cesarean hysterectomy only. There were no statistically significant differences among both groups in the context of the intraoperative measured blood loss. They stated that bilateral IIAL, in cases of AIP undergoing cesarean hysterectomy, isn’t suggested for traditional practice to reduce intraoperative blood loss.

In our study (where we used cervico-isthmic compression suture as a conservative method to save the uterus during the management of PAS), a decrease in intraoperative blood loss was noted among the group without IIAL (Group B) in comparison to the group that had IIAL not only reconfirms the findings of the above studies that IIAL doesn’t decrease intraoperative blood loss among antenatally diagnosed cases of AIP, but it may be even accompanied by increased intraoperative

blood loss when using CIC suture as a conservative method during management.

In a review of the possible management of abnormally invasive placenta, **Armstrong et al.** ⁽²¹⁾ reported that IIAL isn't efficient in managing placental site blood loss in cases of AIP, as well as it postpones the ultimate management needed in such cases. This was revealed in the trial conducted by **Hussein et al.** ⁽⁴⁾ as there was a significant change in the surgical time compared to the control group (223±66 vs 171±41.4 (p=0.001)), with no significant impact on the intraoperative blood loss.

In contrast to our results, **El-Agwany** ⁽²²⁾ in a prospective study involving 20 patients with placenta previa centralis and accreta using cervico-isthmic opposition suture followed by bilateral IIAL as a conservative method to maintain fertility for women wishing it, reported that patient received about 1.5-2 liters of blood throughout the procedure, but he did not report the estimated blood loss.

In the same line, **Refaei et al.** ⁽²³⁾ have demonstrated that prophylactic bilateral IIAL before excision of placenta accreta is an efficient approach to reduce cesarean section adverse events and evade emergency hysterectomy. Bilateral IIAL was carried out in cases with the invasive placenta (accrete and increta) and satisfactory hemostasis was accomplished in 38 cases (38/46 = 82.6%).

Again, cohort research by **Shabana et al.** ⁽²⁴⁾ comprised 71 females. A multidisciplinary stepwise surgical approach, comprising ligations of the anterior division of the IIA on both sides before placental excision, was demonstrated to be efficient in managing blood loss with subsequent preservation of the woman's uterus in about ninety percent of the patients.

The present study revealed that; the rate of hysterectomy was statistically higher among (Group A) (6/21= 28.6%) than among (Group B) (2/21= 9.5%). **El-Sayed et al.** ⁽²⁵⁾ reported a 10% rate of hysterectomy among 50 patients with placenta accreta having intraoperative bilateral IIA ligation (6/50= 12%). But they did not use cervico-isthmic compression sutures during their conservative management. Instead, they used bilateral uterine and ovarian artery ligation or multiple square hemostatic sutures or the two approaches to manage any blood loss from the placental bed. Similarly, **Shabana et al.** ⁽²⁴⁾ in a cohort study including 71 females using a multidisciplinary stepwise surgical approach, comprising bilateral ligations of the anterior division of the iliac arteries before placental excision, reported a 10% hysterectomy rate among the studied women.

On the other hand, **El-Agwany** ⁽²²⁾ in his prospective study involving 20 females with placenta previa centralis and accreta using cervico isthmic opposition suture followed by bilateral IIAL as a conservative method to maintain fertility for women

wishing it, reported that all studied patients were treated successfully.

Regarding postoperative complications, there was a significant difference in the occurrence of postoperative complications among both groups. In group A (the group with IIA ligation), bladder injury occurred in 3 patients (14.3%). On the other hand, in group B (without IIA ligation) bladder injury occurred only in one patient (4.7%). None of the cases developed vascular or neurologic complications. **EL-Sayed et al.** ⁽²⁵⁾ among 50 patients with AIP who underwent bilateral IIAL, reported that three patients in the ligation group were accompanied by bladder injuries and one patient with ureteric injury. **El-Agwany** ⁽²⁶⁾, in his prospective study of patients with AIP who underwent cervico-isthmic opposition sutures followed by bilateral IIAL, reported a high incidence of bladder tears (50%:10/20). He attributed this high possibility of bladder tears to the high development of an adherent high urinary bladder from prior cesarean deliveries, inducing dissection being needed to reach the cervix and abundant varicosity at the operational site. All the tears were repaired by the operating surgeon.

CONCLUSION

It has been concluded that bilateral IIAL, as an intervention to reduce blood loss during conservative management for AIP using cervico-isthmic compression suture (CIC), isn't valuable. It increased the surgical time in a significant manner in comparison to the control group, with no significant impact on intraoperative or postsurgical blood loss. Also, it is accompanied by a higher incidence of urologic complications. These findings make IIA ligation during traditional management of PAS using cervico-isthmic compression sutures not routinely recommended as a prophylactic approach to decrease intraoperative blood loss.

RECOMMENDATION

However, owing to the marked heterogeneity of PAS cases (from mild to moderate to severe) in either group in our study and together with the small sample size included in the study, we recommend the need for further large well- matched studies to make a firmer conclusion and recommendation to our findings.

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