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MATERNAL-FETAL MEDICINE

Modified cesarean hysterectomy technique for management of cases of placenta increta and percreta at a tertiary referral hospital in Egypt

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Abstract

Purpose To evaluate the effect of a modified type II radical hysterectomy on maternal morbidities and mortality in cases with abnormally invasive placenta (AIP).

Methods 63 cases with AIP were managed at one of the largest referral centers in Egypt in a prospective study design. This technique entails devascularization of the uterus laterally on both sides and to clamp the uterus at the lowest possible point just below the level of the placenta while sparing the ureters.

Results The difference between pre- and post-operative hemoglobin was only about 1 gm/dl, and the mean blood loss was 1673 ± 958 ml. There was a significant drop in the post-operative need for blood and blood product replacement, packed red blood cells ($p = 0.013$), fresh red blood cells ($p < 0.001$), and plasma units ($p = 0.012$). Operative time (skin to skin) averaged 190 ± 58.2 min as the technique is slow and utilizes meticulous hemostatic steps. ICU admission was 4.8% with a mean total hospital stay of 8.6 ± 3.6 days. Histopathological examination revealed 58 cases of placenta increta and five percreta cases. We also had 16 bladder injuries (25.4%) and two ureteric injuries, and no maternal mortalities.

Conclusion This technique reduces maternal morbidity and mortality while performing cesarean hysterectomy for cases with AIP.

Keywords Abnormally invasive placenta (AIP) · Accreta · Placenta accreta spectrum (PAS) disorders · Increta · Percreta · Maternal morbidity · Maternal mortality · Modified cesarean hysterectomy

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Abbreviations

AIP	Abnormally invasive placenta
PAS	Placenta accreta spectrum
PRBCs	Packed red blood cells
RBCs	Red blood cells

Introduction

Abnormal placental invasion is defined as invasion of the placental villi to the underling structures. There are varying degrees of invasion which range from attachment to the decidua till attachment to surrounding structures including bladder, bowel, or cervix [1]. This group of placental abnormalities has been redefined recently into placenta accreta spectrum (PAS) disorders, where if the invasion is limited to myometrial attachment, then it would be named as "adherent placenta accreta", while myometrial invasion is labeled as "placenta increta", and invasion of the full thickness of the

myometrium or invasion of the uterine serosa or adjacent organs is termed as "placenta percreta" [2–4].

There is a steep increase in the incidence of PAS disorders over the past few decades from approximately 1/2500 to 1/500 [5]. This increase has been attributed to an increase in cesarean section (CS) rates; however, other causes may be implicated where there was interference with the lining of the uterus as manual placental delivery, uterine curettage, hysteroscopic endometrial resection, previous hysteroscopic surgery and uterine artery embolization. There were even reported cases with no previous history of surgery in cases with submucous myomata, uterine adenomyosis and bicornuate uterus [6].

PAS disorder is a serious condition that is responsible for major obstetric hemorrhage and results in significant maternal morbidity and mortality. Maternal mortality ranges from 4% in developed countries to 14% in developing countries, and accounting for more than half of direct maternal deaths in those regions [7]. Given that techniques that help to reduce blood loss during hysterectomy for these cases such as internal iliac artery ligation have been proven ineffective [8], considerations must be given to modify operative techniques.

Our aim was to evaluate the effect of a modified hysterectomy technique for cases with abnormally invasive placenta (AIP) which includes placenta increta and percreta on related maternal morbidities and mortality.

Methods

Type II (Type B) radical hysterectomy is described by Cibula et al. [9]. The idea for the modifying this technique was to adapt it for use in cases of AIP. This entails devascularizing the uterus laterally and clamping the uterus at the lowest possible point just below the level of the placenta while sparing the ureters.

In this modification, there is no need for the excessive parametrial dissection (increased blood loss) as this is not a case of invasive cervical cancer, and also part of the cervix is spared which was not usually fully invaded by the placenta in most cases. This decreases blood loss in cases of AIP as there are large caliber, low resistance, abnormal vascular connections that develop over the period of pregnancy causing the dissection of the parametrium and bladder to be very bloody.

We recruited women with suspected AIP from January 2014 to January 2017 at Kasr Alainy hospital, Cairo University in a prospective cohort study. The study protocol was approved by "The scientific and ethics Committee" of OBGYN department on December 2013, and all participants were counseled and signed an informed consent. Women enrolled had an age ranging from 20 to 42 years, gestational age ≥ 35 weeks with administered antenatal corticosteroids [10], suspected AIP using 2D ultrasound (loss of retroplacental myometrial interface, placental bed lacunae [6], a thickness of < 1 mm of myometrium retroplacental [11], and multiple coherent vessels seen by 3D power doppler [12].

Exclusion criteria included: pre-operative hemoglobin level < 9 gm/dl, coagulation defects, multi-fetal gestation, if the placenta spontaneously separated, admitted with severe bleeding and operated upon as an emergency (more blood loss and morbidity) as this will affect the main outcome measures [13]. This modified technique was performed by a multidisciplinary team including three consultant obstetricians, two senior anesthesiologists, an on-call urologist, and an on-call vascular surgeon. Pre-operative preparations were done according to guidelines provided by "Placenta accreta. Committee Opinion No. 529" [10].

Operative technique

A midline skin incision is performed with a classical upper segment cesarean section for fetal extraction, after confirming the diagnosis visually as seen in (Fig. 1i). Uterotonics are also given to accelerate placental separation (in cases of AIP uterine contractions cause the placenta to bulge in the weakened lower uterine segment and subsequently allowing for better demarcation and dissection if hysterectomy is needed). If detachment fails and the diagnosis of AIP is confirmed,

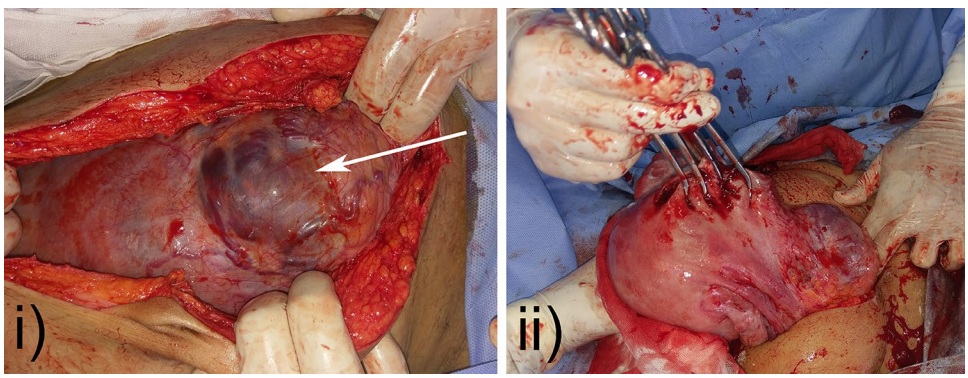

Fig. 1 **i** Midline incision and visual conformation of AIP shown by the arrow. **ii** Uterus is exteriorized and incision is closed with towel clips

the placenta is left in situ with no attempts for removal. The umbilical cord is cut and clamped using a Kocher clamp, and the uterine incision is closed using four towel clips as shown in (Fig. 1ii), and the uterus is exteriorized.

The technique modification hinges upon four main axial points 4(D)s:

1. Dissection of the posterior fold of the broad ligament's peritoneum till the level of the base of the broad ligament and mobilizing the ureter laterally.
2. Devascularization of the broad ligament lateral to the uterus.
3. Delayed dissection of the anterior fold of the broad ligament's peritoneum and mobilizing the bladder downwards (where most blood loss occurs due to bladder or placental injury) till below the level placental attachment.
4. Demarcation of the level of the placenta and then clamping the vascular pedicle containing the uterine vessels just below its level.

After clamping and ligating the round and infundibulopelvic ligaments as in any hysterectomy, the broad ligament becomes accessible. An avascular plane is identified as shown in (Fig. 2i) (video 1), and the posterior leaflet of the peritoneum is incised vertically downwards (Fig. 2ii) parallel to the uterine body and cervix carefully along the avascular plane (Fig. 3i) (video 2). This is done down to the level where the ureter is identified (Fig. 3ii) (video 3) and dissection is then continued downwards medial to the ureter displacing it laterally till below the level of the placenta or the pelvic floor is reached. The anterior leaflet of the broad ligament is dissected downward till below the level of the placenta or till the pelvic floor is reached. Meticulous hemostasis is essential in this step to avoid uncontrollable bleeding which would cause surgery to be hectic.

The same steps following the same sequence are conducted at the other side of the uterus to prepare for the final step of bladder mobilization. We always opt to start with the side opposite to the side on which the placenta is more bulging (high vascularity, congested vessels and abnormal vascular communications are usually present).

Dissection is then continued (laterally to anterior) till the level of the bladder attachment to the lower uterine segment is reached. Careful mobilization of the bladder downwards is done by a combination of both blunt and sharp dissection

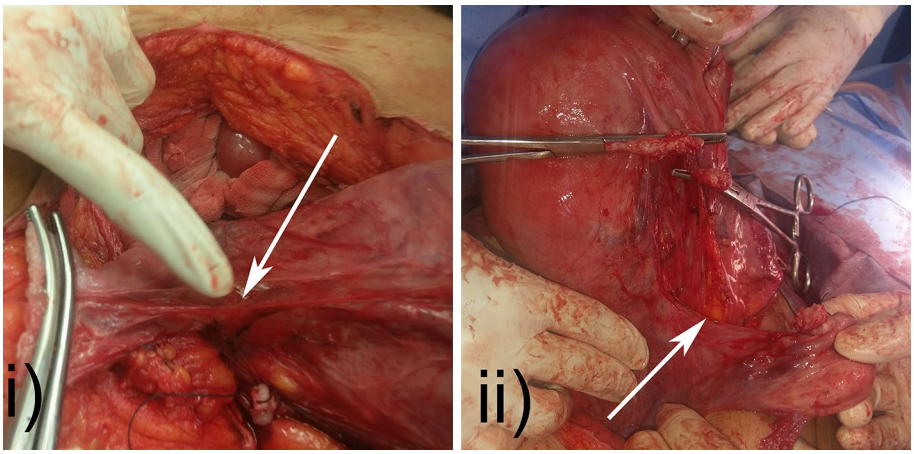

Fig. 2 **i** Identification of an avascular plane as shown by the arrow. **ii** Posterior leaflet of the peritoneum is incised vertically downwards as shown by the arrow

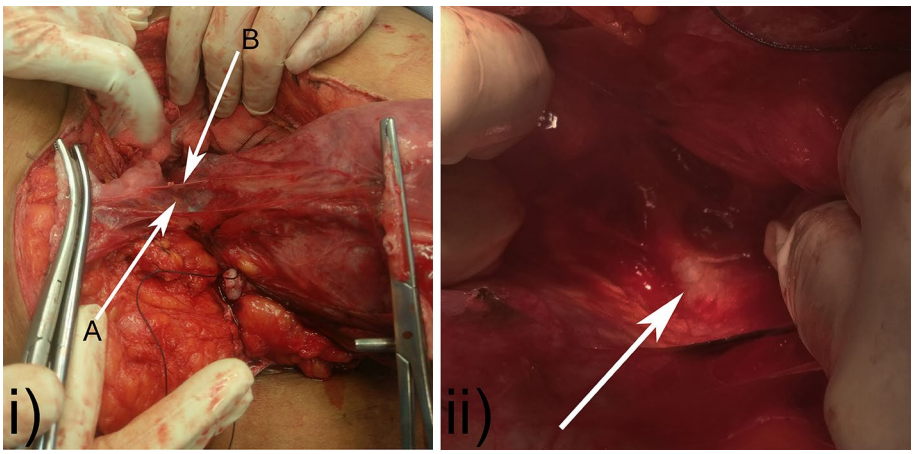

Fig. 3 **i** highlights the plane along which dissection continues, arrow (A) shows the avascular plane, (B) shows the posterior leaflet of the broad ligament. **ii** Identification of the ureter as shown by the arrow

using a strict hemostatic technique (special considerations are made when bladder serosal invasion is suspected before surgery).

When the bladder has been fully mobilized below the level of the placenta (Fig. 4i) (or in some cases to the level of the pelvic floor), the ureters are now completely displaced out of the way below the level of the placenta. Two curved Heaney clamps are placed just below the level of the placenta sparing the bladder and the ureters while clamping both ascending uterine arteries as shown in Fig. 4ii (video 4). The vascular pedicle between these clamps is divided and double ligated on both sides.

Straight clamps (Kocher or Masterson) are then used to identify and clamp the edges of the remaining cervical tissues as the uterus is removed below the level of the placenta but above the level of the vascular pedicles (Fig. 5i). The remaining stump is then sutured (Fig. 5ii).

A test of the bladder integrity is done if bladder injury is suspected. The bladder is filled with 200–300 cc saline 0.9% solution containing methylene blue dye through the catheter, and any leakage is reported and corrected immediately by the team's urologist. Hemostasis is then done, securing any bleeding points and abdomen is closed in layers.

When suspecting bladder invasion, the dome of the bladder is incised, and bladder is dissected away from the uterus while ligating any blood vessels, securing as much bladder wall as possible (Fig. 6). The technique of bladder repair is left up to the urologist (according to the amount bladder wall resection, using omental flaps (etc.).

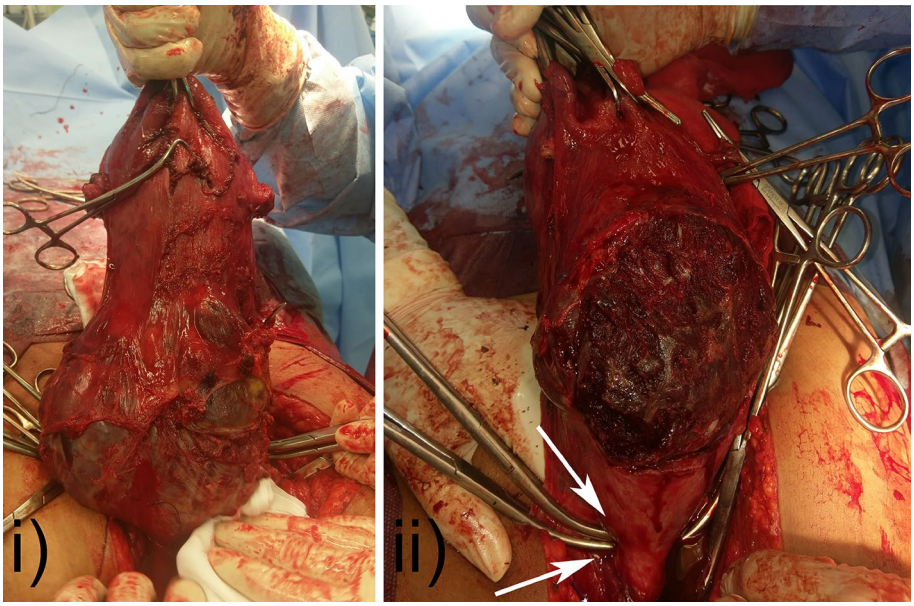

Fig. 4 **i** Bladder and ureters fully mobilized below the level of the placenta. **ii** Clamping of the vascular pedicles below the level of the placenta as shown by the arrows

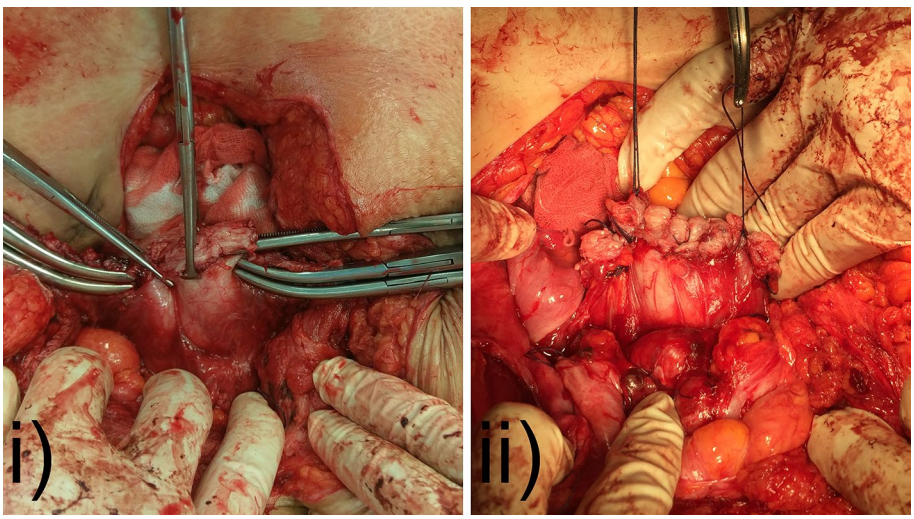

Fig. 5 **i** Straight clamps are then used to identify edges of the remaining cervical tissues.**ii** Suturing of the remaining stump

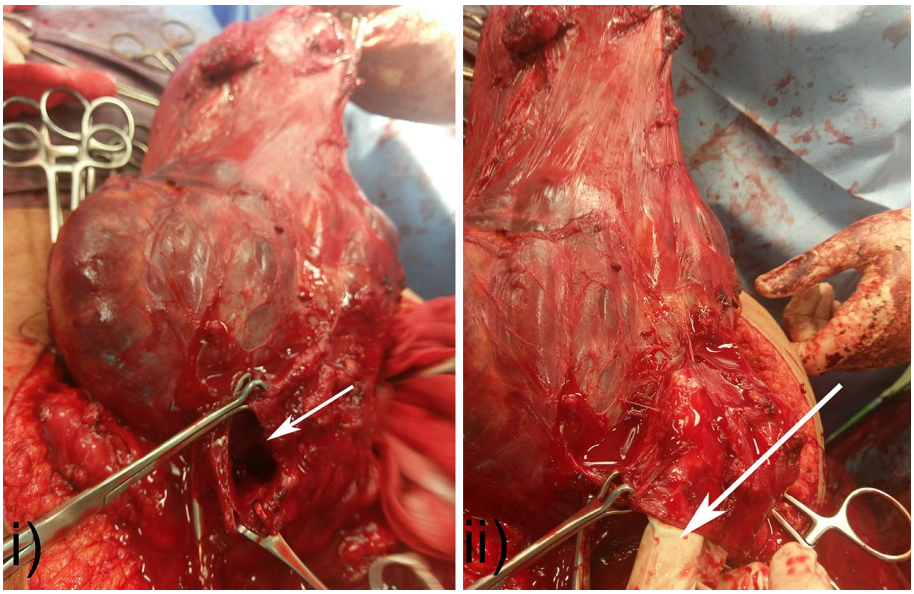

Fig. 6 **i** Bladder dome is incised as shown by the arrow. **ii** Urologist's finger is inside the bladder as shown by the arrow, to help guide him dissect the bladder wall away from the placenta if possible

- *Primary outcome* To document cases of maternal mortality due to excessive blood loss.
- *Secondary outcome* To evaluate maternal morbidity through estimated blood loss, hemoglobin drop, blood and blood product transfusion, ureteric and bladder injuries, ICU and intermediate care admissions, and hospital stay.
- *Outcome measures* Pre- and 48-h post-operative hemoglobin, estimated blood loss, intra and post-operative blood transfusion using PRBCs units, fresh RBCs units and plasma were recorded. Intensive care unit (ICU) admission, intermediate care admission, number of days spent outside standard obstetric ward, total duration of hospital stay, and any operative complications were also recorded. Blood loss was calculated according to the work done by Kamel et al. [14], where the volume of blood in the suction apparatus (excluding liquor at the time of cesarean) was added to the calculated volume of blood from the measured weight of the soaked towels and drapes placed beneath the patients using the following formula: (WET item gram weight − DRY item gram weight = milliliters of blood within the item) [15].

Data were statistically described in terms of mean ± SD or number (%). Paired samples *t* test was used to compare numerical data. A p value < 0.05 was considered as statistically significant. Data analysis was performed using the Statistical Package for the Social Sciences program, v20.0 (SPSS Inc., Chicago, IL, USA).

Results

Over the study duration, we recruited 68 women as we are the largest referral center for cases of suspected AIP in Egypt. In five cases, the placenta separated spontaneously and they were managed conservatively by hemostatic sutures at the site of the placental bed, and they were excluded from our study leaving 63 cases that underwent the intervention.

The site of placental attachment was anterior uterine wall in all the cases (no posterior or fundal attachment). All the cases of AIP were related to previous CS scar, while 77.7% of cases were placenta previa, only 86% of them were complete centralis (completely covering the internal OS). In 46 cases (74%), there was a remaining cervical stump below the level of amputation; however, there was no post-operative vaginal bleeding in these cases that required reoperation (stump removal). Histopathological

Table 1 Showing demographic data of the included study population

	Minimum	Maximum	Mean ± SD
Age (years)	20	41	32.1 ± 4.2
Gravidity (*n*)	3	8	4.6 ± 1.1
Parity (*n*)	2	7	3.3 ± 1
Previous miscarriages (*n*)	0	3	1.2 ± 0.8
Previous cesarean scars (*n*)	1	7	3.1 ± 1.1
Gestational age by date (weeks)	35	37.3	35.9 ± 0.6
Ultrasound estimated gestational age (weeks)	33.7	38	36.1 ± 0.8

Values are given as mean ± SD (95% CI)

examination of our specimens revealed 58 of cases of placenta increta and five cases of percreta.

Table 1 shows the demographics of the recruited women, which includes a mean age of 32.1 ± 4.2 years with 3.1 ± 1.1 previous cesarean scars and an average gestational age of 35.9 ± 0.6 weeks at delivery.

We had no cases of maternal mortalities while using this technique, and a mean blood loss of only 1673 ± 958 ml. Although there was a statistically significant drop between pre- and post-operative hemoglobin ($p < 0.001$) which is to be expected in such cases, the drop in post-operative hemoglobin was about 1 gm/dl as shown in Table 2.

While 86% of the participants required blood transfusion (54 cases), only an average of one a unit of blood, PRBCs and plasma were used intra-operative, and none of our cases required replacement with cryoprecipitate or platelets. When we compared intra-operative versus post-operative need for blood and blood product replacement, we found a significant decrease in the need to continue replacement with PRBCs ($p = 0.013$), fresh RBCs ($p < 0.001$), and plasma ($p = 0.012$).

Operative time (skin to skin) averaged 190 ± 58.2 min as the technique is slow and utilizes meticulous hemostatic steps due to the engorged abnormal vascular connections present at the site of the AIP. Intermediate care ward admission was 88.9% (56 cases) with a maximum stay of 4 days and a mean of 1.2 ± 0.8 days. Only three cases were admitted to the ICU (4.8%), and the total hospital stay ranged from 3 to 21 days with an average stay of 8.6 ± 3.6 days. We also had 16 bladder injuries (25.4%) and two ureteric injuries.

Table 2 Findings using the new technique

	Minimum	Maximum	Mean ± SD
Pre-operative hemoglobin (g/dl)	9.3	13	10.8 ± 0.8
Post-operative hemoglobin (g/dl)	8.7	11.2	9.9 ± 0.5
Estimated blood loss (ml)	500	6500	1673 ± 958
Operative time (mins)	100	420	190 ± 58.2
Intra-OP packed RBCs units (*n*)	0	8	0.8 ± 1.6
Post-OP packed RBCs units (*n*)	0	7	0.2 ± 0.9
Intra-OP fresh RBCs units (*n*)	0	4	1.3 ± 0.8
Post-OP fresh RBCs units (*n*)	0	4	0.3 ± 0.7
Intra-OP plasma units (*n*)	0	7	1 ± 1.6
Post-OP plasma units (*n*)	0	10	0.3 ± 1.4
Intermediate care admission (days)	0	4	1.2 ± 0.8
Hospital stay (days)	3	21	8.6 ± 3.6

Values are given as mean ± SD (95% CI)

Difference in means using paired samples *t* test

RBCs red blood cells, *OP* operative

Discussion

Placenta accreta is a life-threatening condition with significant maternal morbidity and mortality. Although an individualized treatment plan has been recommended for cases with AIP, cesarean hysterectomy remains the method of choice for its management if the patient has completed her family, or if conservative management fails [10]. Our main findings show that while using the above modified technique we had no maternal mortalities, reduced operative blood loss, post-operative blood transfusion, ICU admission and other maternal morbidities.

Typically blood loss ranges between 2000 and 5000 ml in cases undergoing CS hysterectomy for AIP [13, 16, 17], and in some instances up to 10,000 ml [18]. This technique shows a fundamental decrease in blood loss, need for post-operative blood transfusion and the number of units of blood transfused. Other studies show that nearly 90% of cases need blood transfusion, with 40% requiring more than ten units [13, 19]. While we have had no maternal mortalities using this technique, others have reported maternal deaths to reach up to 7% [19].

While other novel techniques were described by researchers [20–23], which included staple device by Belfort et al. and vessel sealing device by Rossetti et al., only Shamshirsaz et al. described a technique similar to ours with careful stepwise devascularization of the broad ligament; however, all women underwent ureterolysis and ureteric stent placement, with the cervix totally removed which leads to more blood loss [20]. We had less average blood loss with less rates of bladder injury, blood transfusion and similar rates of ureteric injury, with no reoperation.

The rate of bladder injury was comparable to the study by Asıcıoglu et al. [13] (31.4%) and the meta-analysis by Washecka and Behling [24] (26%). ICU admission was low compared to 14% reported by Upson et al. [25], 64% by Brookfield et al. [26] and 45.8% described during elective surgery by Weiniger et al. [27]. We only had two cases of ureteric injury with this procedure (3.2%) which compares well to other studies including 5.7% in Asıcıoglu et al., and 6% with Washecka and Behling [13, 24]. The role of ureteric stenting in cases with AIP remains inconclusive; our trained team had no difficulties identifying the ureter without stenting similar to other authors who found no significant decrease in early maternal morbidity and ureteric injury when stenting was done [28, 29].

Being one of the largest referral centers in the region, we receive all cases with suspected AIP which gave us an advantage in studying such a large sample size in the given time frame for the study. Conservative modalities in treating AIP are not feasible in most of our cases as they

were referred from different governorates in Egypt. This makes conservative management very difficult as patient compliance with treatment and follow-up is difficult due to the geographical distribution of the patient's place of residence. That is what makes definitive treatment using hysterectomy more appealing than other conservative measures and our hospital's primary modality for treatment in such cases.

Most of the studies that were successful in the conservative management of AIP for all or the majority of their cases without having to resort to secondary hysterectomy did not elaborate on the depth of placental invasion, and the final histopathological diagnosis was missing [30–32]. In this work, we presented the histopathology for all our participants, and included the specimen photos as supplementary material to show the extent of placental invasion.

The fact that we are a developing country with little resources has limited our use of known interventional radiology, and vascular balloon techniques as the equipment and the trained personal are not available, and given that this approach carries the potential to reduce costs related to operative management of AIP due to decreased personnel, blood transfusion, ICU admission and hospital stay, makes it optimum for implementation in a low resource setting.

Limitations to our work were mainly due to choosing a cohort study design. Selecting an appropriate study design was challenging as a retrospective design carried so many variables for a control group, while a randomized control design to compare this technique to a conventional cesarean hysterectomy has some ethical considerations. The development of this modified technique and the results obtained were the product of work done by a trained specialized team, so after developing this technique, we are unable to ethically subject a control group to the increased morbidity and mortality rates carried by standard cesarean hysterectomy. While a cohort study lacks the ability to directly compare this technique to other modifications and modalities available, we did, however, overcome this flaw by comparing our results to other published techniques.

In conclusion, this modified technique reduces maternal morbidity and mortality, while performing cesarean hysterectomy for cases with AIP. Although this approach increased operative time, the outcome is encouraging. Further research is needed to compare this approach to other conservative measures and to evaluate it in emergency cases, while considering operative cost reduction.

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Author contributions AMH: Protocol/project development, obstetrics and gynecological surgery, data analysis, manuscript writing/editing. AK: Protocol/project development, obstetrics and gynecological surgery, data analysis, manuscript writing/editing. AR: Obstetrics and gynecological surgery, data collection or management, manuscript writing/editing. DMD: Obstetrics and gynecological surgery, data collection or management, manuscript writing/editing. AA: Obstetrics and gynecological surgery, data collection or management, manuscript writing/editing. MN: Obstetrics and gynecological surgery, data collection and management, data analysis, manuscript writing/editing. MM: Obstetrics and gynecological surgery, data analysis, manuscript writing/editing.

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Compliance with ethical standards

Conflict of interest The authors of this study declare no conflict of interest and no competing interests with respect to the research, authorship and publication of this article.

References

1. Silver RM, Barbour KD (2015) Placenta accreta spectrum: accreta, increta, and percreta. Obstet Gynecol Clin North Am 42(2):381–402. https://doi.org/10.1016/j.ogc.2015.01.014
2. Jauniaux E, Ayres-de-Campos D (2018) FIGO consensus guidelines on placenta accreta spectrum disorders: introduction. Int J Gynaecol Obstet 140(3):261–264. https://doi.org/10.1002/ijgo.12406
3. Alfirevic Z, Tang AW, Collins SL, Robson SC, Palacios-Jaraquemada J (2016) Pro forma for ultrasound reporting in suspected abnormally invasive placenta (AIP): an international consensus. Ultrasound Obstet Gynecol 47(3):276–278. https://doi.org/10.1002/uog.15810
4. Collins SL, Ashcroft A, Braun T, Calda P, Langhoff-Roos J, Morel O, Stefanovic V, Tutschek B, Chantraine F (2016) Proposal for standardized ultrasound descriptors of abnormally invasive placenta (AIP). Ultrasound Obstet Gynecol 47(3):271–275. https://doi.org/10.1002/uog.14952
5. Wu S, Kocherginsky M, Hibbard JU (2005) Abnormal placentation: twenty-year analysis. Am J Obstet Gynecol 192(5):1458–1461. https://doi.org/10.1016/j.ajog.2004.12.074
6. Jauniaux E, Collins SL, Jurkovic D, Burton GJ (2016) Accreta placentation: a systematic review of prenatal ultrasound imaging and grading of villous invasiveness. Am J Obstet Gynecol 215(6):712–721. https://doi.org/10.1016/j.ajog.2016.07.044
7. Sakhavar N, Heidari Z, Mahmoudzadeh-Sagheb H (2015) Cervical inversion as a novel technique for postpartum hemorrhage management during cesarean delivery for placenta previa accreta/increta. Int J Gynaecol Obstet 128(2):122–125. https://doi.org/10.1016/j.ijgo.2014.08.020
8. Hussein AM, Refaat Dakhly DM, Raslan AN, Kamel A, Hafeez AA, Moussa M, Hosny AS, Momtaz M (2018) The role of prophylactic internal iliac artery ligation in abnormally invasive placenta undergoing caesarean hysterectomy: a randomized control trial. J Matern Fetal Neonatal Med. https://doi.org/10.1080/14767058.2018.1463986
9. Cibula D, Abu-Rustum NR, Benedetti-Panici P, Kohler C, Raspagliesi F, Querleu D, Morrow CP (2011) New classification system of radical hysterectomy: emphasis on a three-dimensional

anatomic template for parametrial resection. Gynecol Oncol 122(2):264–268. https://doi.org/10.1016/j.ygyno.2011.04.029
10. Committee on Obstetric Practice (2012) Committee opinion no. 529: placenta accreta. Obstet Gynecol 120(1):207–211. https://doi.org/10.1097/aog.0b013e318262e340
11. Gielchinsky Y, Mankuta D, Rojansky N, Laufer N, Gielchinsky I, Ezra Y (2004) Perinatal outcome of pregnancies complicated by placenta accreta. Obstet Gynecol 104(3):527–530. https://doi.org/10.1097/01.aog.0000136084.92846.95
12. Shih JC, Palacios Jaraquemada JM, Su YN, Shyu MK, Lin CH, Lin SY, Lee CN (2009) Role of three-dimensional power Doppler in the antenatal diagnosis of placenta accreta: comparison with gray-scale and color Doppler techniques. Ultrasound Obstet Gynecol 33(2):193–203. https://doi.org/10.1002/uog.6284
13. Asicioglu O, Sahbaz A, Gungorduk K, Yildirim G, Asicioglu BB, Ulker V (2014) Maternal and perinatal outcomes in women with placenta praevia and accreta in teaching hospitals in Western Turkey. J Obstet Gynaecol 34(6):462–466. https://doi.org/10.3109/01443615.2014.902040
14. Kamel A, El-Mazny A, Salah E, Ramadan W, Hussein AM, Hany A (2017) Manual removal versus spontaneous delivery of the placenta at cesarean section in developing countries: a randomized controlled trial and review of literature. J Matern Fetal Neonatal Med. https://doi.org/10.1080/14767058.2017.1369522
15. (2015) Quantification of blood loss: AWHONN practice brief number 1. J Obstet Gynecol Neonatal Nurs 44(1):158–160. https://doi.org/10.1111/1552-6909.12519
16. Warshak CR, Ramos GA, Eskander R, Benirschke K, Saenz CC, Kelly TF, Moore TR, Resnik R (2010) Effect of predelivery diagnosis in 99 consecutive cases of placenta accreta. Obstet Gynecol 115(1):65–69. https://doi.org/10.1097/AOG.0b013e3181c4f12a
17. Angstmann T, Gard G, Harrington T, Ward E, Thomson A, Giles W (2010) Surgical management of placenta accreta: a cohort series and suggested approach. Am J Obstet Gynecol 202(1):38.e31–38.e39. https://doi.org/10.1016/j.ajog.2009.08.037
18. Clark SL, Phelan JP, Yeh SY, Bruce SR, Paul RH (1985) Hypogastric artery ligation for obstetric hemorrhage. Obstet Gynecol 66(3):353–356
19. O'Brien JM, Barton JR, Donaldson ES (1996) The management of placenta percreta: conservative and operative strategies. Am J Obstet Gynecol 175(6):1632–1638
20. Shamshirsaz AA, Fox KA, Salmanian B, Diaz-Arrastia CR, Lee W, Baker BW, Ballas J, Chen Q, Van Veen TR, Javadian P, Sangi-Haghpeykar H, Zacharias N, Welty S, Cassady CI, Moaddab A, Popek EJ, Hui SK, Teruya J, Bandi V, Coburn M, Cunningham T, Martin SR, Belfort MA (2015) Maternal morbidity in patients with morbidly adherent placenta treated with and without a standardized multidisciplinary approach. Am J Obstet Gynecol 212(2):218.e211–218.e219. https://doi.org/10.1016/j.ajog.2014.08.019
21. Belfort MA, Shamshirsaz AA, Fox KA (2017) A technique to positively identify the vaginal fornices during complicated postpartum hysterectomy. Am J Obstet Gynecol 217(2):222.e221–222.e223. https://doi.org/10.1016/j.ajog.2017.05.001
22. Selman AE (2016) Caesarean hysterectomy for placenta praevia/accreta using an approach via the pouch of Douglas. BJOG 123(5):815–819. https://doi.org/10.1111/1471-0528.13762
23. Rossetti D, Vitale SG, Bogani G, Rapisarda AM, Gulino FA, Frigerio L (2015) Usefulness of vessel-sealing devices for peripartum hysterectomy: a retrospective cohort study. Updates Surg 67(3):301–304. https://doi.org/10.1007/s13304-015-0289-0
24. Washecka R, Behling A (2002) Urologic complications of placenta percreta invading the urinary bladder: a case report and review of the literature. Hawaii Med J 61(4):66–69
25. Upson K, Silver RM, Greene R, Lutomski J, Holt VL (2014) Placenta accreta and maternal morbidity in the Republic of Ireland, 2005–2010. J Matern Fetal Neonatal Med 27(1):24–29. https://doi.org/10.3109/14767058.2013.799654
26. Brookfield KF, Goodnough LT, Lyell DJ, Butwick AJ (2014) Perioperative and transfusion outcomes in women undergoing cesarean hysterectomy for abnormal placentation. Transfusion 54(6):1530–1536. https://doi.org/10.1111/trf.12483
27. Weiniger CF, Kabiri D, Ginosar Y, Ezra Y, Shachar B, Lyell DJ (2016) Suspected placenta accreta and cesarean hysterectomy: observational cohort utilizing an intraoperative decision strategy. Eur J Obstet Gynecol Reprod Biol 198:56–61. https://doi.org/10.1016/j.ejogrb.2015.12.020
28. Eller AG, Porter TF, Soisson P, Silver RM (2009) Optimal management strategies for placenta accreta. BJOG 116(5):648–654. https://doi.org/10.1111/j.1471-0528.2008.02037.x
29. Belfort MA (2010) Placenta accreta. Am J Obstet Gynecol 203(5):430–439. https://doi.org/10.1016/j.ajog.2010.09.013
30. Mazouni C, Palacios-Jaraquemada JM, Deter R, Juhan V, Gamerre M, Bretelle F (2009) Differences in the management of suspected cases of placenta accreta in France and Argentina. Int J Gynaecol Obstet 107(1):1–3. https://doi.org/10.1016/j.ijgo.2009.04.021
31. El Behery MM, Rasha LE, El Alfy Y (2010) Cell-free placental mRNA in maternal plasma to predict placental invasion in patients with placenta accreta. Int J Gynaecol Obstet 109(1):30–33. https://doi.org/10.1016/j.ijgo.2009.11.013
32. Chantraine F, Blacher S, Berndt S, Palacios-Jaraquemada J, Sarioglu N, Nisolle M, Braun T, Munaut C, Foidart JM (2012) Abnormal vascular architecture at the placental-maternal interface in placenta increta. Am J Obstet Gynecol 207(3):188.e181–188.e189. https://doi.org/10.1016/j.ajog.2012.06.083