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Original Article

Combined Internal Iliac Artery Ligation, Transverse B-Lynch Suture and Intrauterine Balloon to Control Bleeding from Placenta Accreta during Caesarean Delivery

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ABSTRACT

Introduction and aim: Placenta praevia and accreta are associated with high morbidity and mortality. Bleeding is the sole etiology of both morbidity and mortality. Thus, anti-bleeding measures are mandatory and research continues to search for ideal prophylactic measure. This work was designed to assess the efficacy of bilateral internal iliac artery ligation followed by Transverse B-Lynch compression suturing and intrauterine balloon tamponade as a conservative methods to control placental site bleeding due to placenta praevia accreta.

Methodology: The study included 24 pregnant females with placenta praevia accreta who were scheduled for elective cesarean section. All participants were subject to history taking, clinical evaluation and laboratory investigations. Ultrasound examination was carried out for assessment of: Estimated fetal weight, confirmation of gestational age, confirm diagnosis of placenta previa accreta and level of the placental edge in lower uterine segment. Deliveries were scheduled to take place between 36-37 weeks of gestation. The primary outcome was the amount of intra-operative blood loss.

Results: Blood loss ranged between 249.29 and 560.43 ml, and there was statistically significant decrease of hematocrit percent and platelets after surgery when compared to corresponding values before surgery. All females need blood transfusion. However, none of them need further surgical intervention or intensive care unit admission.

Conclusion: Prophylactic bilateral internal iliac artery ligations before extraction of placenta accreta followed by transverse B Lynch suture and intrauterine balloon tamponade seemed to be an effective and safe technique to reduce intrapartum and postpartum complications, and to avoid emergent peripartum hysterectomy.

Keywords: Abnormal Placentation; Internal Iliac Artery Ligation; B-Lynch; Intrauterine Balloon; Placenta accreta.

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INTRODUCTION

Placenta previa (PP) is a relatively serious obstetric complications. It describes abnormal presence of placental parts on the lower uterine segment. Its etiopathogenesis is not accurately recognized. However, a well-known risk factor for the development of PP is the uterine scar. Other risk factors may include multi-parity, advanced maternal age, previous PP, and congenital uterine malformations. PP prevalence is about 5 per 1000 pregnancies. However, regional differences were reported ⁽¹⁾.

Placenta accreta describes an abnormal placental attachment with the myometrium (i.e., abnormal placentation). This condition could be categorized into accreta (i.e., placental villi attached to myometrium) or percreta (i.e., placental villi invade the myometrium). PP accreta increased among women with previous cesarean sections, with positive correlation with the number of previous sections. For example, the prevalence of placenta previa accreta reached 3% in all populations that could be increased to 60.0% in women with PP with \geq 4 cesarean deliveries⁽²⁾.

Placenta previa and previa accreta are associated with higher neonatal and maternal complications and mortality, which increased when discovered accidentally during delivery. However, the prevalence of PP and accreta continuous to increased progressively. This could be attributed to the increased rates of cesarean sections, the use of the assisted reproduction techniques (ARTs) and advanced maternal age ⁽³⁾.

The standard treatment of placenta-accreta is hysterectomy. However, a conservative treatment could be considered if heavy bleeding and/or coagulopathy are absent, especially in women with low parity ⁽⁴⁾.

One of such conservation procedures is the bilateral uterine artery ligation or embolization to preserve fertility power and previous blood flow ⁽⁵⁾.

Combination technique of external compression incorporating the UCS and internal uterine tamponade (uterine sandwich) using a balloon has been employed which applies forces to both the external as well as the internal surfaces of the myometrium ⁽⁶⁾.

The B-Lynch suture was first developed by Christopher B-Lynch in 1997 as a conservative surgical management option that was easy to apply and required no special surgical training. It was employed mostly for treating atonic uterus that does not respond to medical management⁽⁷⁾.

THE AIM OF THE WORK

The present work aimed to assess the efficacy of bilateral internal iliac artery ligation followed by Transverse B-Lynch suture and intrauterine balloon tamponade as a conservative methods to control bleeding at placental site due to placenta praevia accreta.

PATIENTS AND METHODS

The study was conducted at Department of Obstetrics and Gynecology department (Damietta Faculty of Medicine, Al-Azhar University Hospital, Damietta, Egypt).

It was carried out from July to December 2019. It included 24 pregnant females with placenta praevia accreta who were scheduled for elective cesarean section.

Patient was included if she aged 18-35 years (reproductive age period), gestational age more than 34 weeks, had confirmed diagnosis of placenta previa accreta, with singleton pregnancy.

On the other side, exclusion criteria were: known bleeding disorder, hypertensive disorders, ante-partum hemorrhage (APH) and emergency caesarean section.

The calculation of sample size was designed to avoid type II error; and to be clinically significant, it was supposed that combined internal iliac artery ligation, transverse B-Lynch suture and intrauterine balloon should reduce intra-operative blood loss by 50% according to Sanad *et al.* ⁽¹⁾

According to these data, we needed to study 24 patients to be able to reject the null where the power was 80% and the type one error probability related with this test for the null hypothesis is 0.05.

After explanation of the nature of the study to all participant and approval of the study by the local ethics committee (ADIM-IRB 13032019), an informed written consent was taken from all participant before starting the study with counseling about the risk of intra-operative hemorrhage and postpartum hemorrhage (PPH), the necessity for massive transfusion of blood products and the likelihood of cesarean hysterectomy if required to stop severe bleeding and the need for re-laparotomy and intensive care unit (ICU) admission.

After that, all participants were subject to full history taking, clinical evaluation and laboratory investigations (complete blood count and coagulation profile).

In addition ultrasound examination was carried out for measurement of: Estimated fetal weight (EFW) and confirmation of gestational age; confirm diagnosis of placenta previa accreta; and to determine the level of the placental edge in lower uterine segment. Deliveries were scheduled to take place between 36-37 weeks of gestation according to guidelines⁽³⁾.

Operative details:

Before operation, the hemoglobin level should not be less than 11 gm% and four to six blood units plus four to six fresh frozen plasma units were cross matched and ready. Skin incision was done through Pfannenstiel approach and layers of the anterior abdominal wall had been incised separately.

The loose peritoneum on the lower segment of the uterus was surgically dissected to expose the segment and permit downward mobilization of the urinary bladder. Higher uterine incision had been performed away from the placenta. Then, delivery of the fetus followed by bilateral internal iliac artery ligation.

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After that, the delivery of placenta was carried out, followed by transverse B-lynch suture, and Foleys catheter no 24 had been placed in the uterine cavity and the lower end had been passed through the cervical canal. Closure of uterine incision, anterior abdominal wall, and skin incision was carried out in a conventional manner.

The outcomes of the study included the following:

Primary outcome:

The amount of intra-operative blood loss measured by amount of blood in the container and weight of soaked towels before and after operation. The change in pre- and post-partum values of hemoglobin concentration and the need for blood transfusion.

The secondary outcomes:

The necessity for additional surgical intervention to control intra-operative bleeding, the whole operative time calculated with onset of skin incision to skin closure, urological injury, postoperative assessment include pulse, blood pressure, complete blood count (CBC), development of disseminated intravascular coagulation (DIC), intensive care unit (ICU) admission and the need for relaparotomy and duration of post-operative hospital stay.

Technique of Bilateral IIAL:

The broad ligament enveloped the uterus anteriorly and posteriorly. It continues on the lateral pelvic wall as the pelvic peritoneum. After cutting of pelvic peritoneum, the retroperitoneal area was visualized. Then, the paracolic area was reached by forward extension of the incision, parallel to the infundibulo-pelvic ligament.

The ureter and infundibulo-pelvic ligament were exposed by medial dragging of the posterior part of the broad ligament.

Over the sacroiliac joint, the common iliac artery was identified. Adipose and lymphatic tissues were dissected over the internal iliac artery, to expose the posterior division at the first 3-4 cm, where the anterior division starts after and internal artery ligation was completed at this point.

For uncontrollable bleeding, the ligation of the internal iliac artery was performed at the start of anterior division.

Technique of Transverse B-Lynch:

We used the suture material monocryl 100 cm mounted on $\frac{1}{2}$ circle needle. The blunt-ended needle was used to pierce the uterus posteriorly, 3 cm above the upper margin of the incision and behind the vascular bundle with the uterine tilted to the surgeon direction.

The needle was retrieved through the uterine cavity and dragged inferiorly on the posterior wall of the cavity.

The needle then punctures the posterior wall of the uterus 3 cm lower to the inferior margin of the cesarean incision and behind the vascular bundle below the incision margin.

The needle then punctures the posterior side of the uterus behind the vascular bundle.

The suture was allowed to ascend lying freely on the posterior wall of the uterine cavity and exits 3 cm above the upper margin of the cesarean incision exiting posteriorly and back to the vascular bundle to meet contralateral side suture.

Statistical Analysis:

Collected data include data of the history, clinical examination, laboratory investigations and outcome measures. Data was analyzed by Statistical Package for the Social Sciences (SPSS version 20.0) (IBM, SPSS, Inc., Chicago, USA) software, running on personal computer.

Qualitative data were expressed by their number and percentage, while quantitative data were expressed by their arithmetic mean (for central tendency) and standard deviation (SD) for dispersion.

Median and Interquartile ranges were used for non-parametric data. Paired samples (t) test was used to compare variables after and before intervention. *P* value <0.05 was considered significant.

RESULTS

In the present work, 24 females, their age was between 19 and 33 years, nine (37.5%) were in the age group 18-25 years and 15 (62.5%) were in the age group 26 to 35 years old.

The gravidity lies between 1 and 8 with mean value of 4.08 ± 1.91 ; while parity ranged between 1 and 7 with a mean value of 2.75 ± 1.59 . The gestational age at diagnosis ranged between 34 and 37 weeks; 62.5% of females were between 34 and 37 weeks and only 37.5% were at \geq 37.

In addition, the mean pulse was 84.25 ± 8.44 with range of (70.0 - 97.0) beat/min, mean systolic blood pressure was 119.58 ± 9.55 , with range of 100.0 - 130.0, mean diastolic blood pressure was 75.42 ± 8.84 , with range of 60.0 - 90.0, mean temperature was 36.96 ± 0.30 with range of 36.50 - 37.70.

Furthermore, the previous uterine surgery was in form of CS in 12 (50%) patients, D& C in 8 (33.3%) and both among 4 patients (16.7%) (Table 1).

In the present study, blood loss ranged between 1249.29 and 1560.43 ml, the mean blood loss was 1459.04 ± 121.84 (Table 2).

In the present work, there was statistically significant decrease of hematocrit percent and platelets after surgery when compared to corresponding values before surgery. However, there was no significant difference regarding hemoglobin and RBCs (Table 3).

As regard to secondary outcome, all females need blood transfusion. However, none of them need further surgical intervention or ICU admission (Table 4).

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Table (1): Patient characteristics, hemodynamics and previous uterine surgery					
Variable	(MinMax.)	(mean±SD)	Median (IQR)		
Age (yeas)	19- 33	(25.96± 4.50)	25.50 (22.0 - 30.0)		
Gravidity	1.0 -8.0	(4.08 ±1.91)	4.0 (3.0 –5.0)		
Parity	1.0 -7.0	(2.75 ±1.59)	3.0 (1.5 0 –3.0)		
Gestational age	36.0 - 37.0	36.38 ± 0.49	36.0 (36.0 –37.0)		
Pulse	70.0 –97.0	84.25 ±8.44	86.0(76.50 -90.50)		
Systolic	100.0 -130.0	119.58 ±9.55	120.0(110.0 - 130.0)		
Diastolic	60.0 –90.0	75.42 ±8.84	70.0(70.0 -80.0)		
Temperature	36.50 - 37.70	36.96 ± 0.30	36.90(36.80 - 37.20)		
Previous	uterine surgery (n, %)	Cesarean delivery	12(50.0%)		
		D&C	8(33.3%)		
		Both	4(16.7%)		

Table (2): Blood loss (ml) among studied patients

	Blood loss
Min. – Max.	1249.29 1 –560.43
Mean ± SD.	1459.04 ±121.84
Median (IQR)	1403.40(1319.5 1 -471.6)

Table (3): Comparison between two studied period (before and after operation) according to hemoglobin, hematocrit, RBCs and platelets

	Before	After	t	p
Hemoglobin	11.46 ±1.06	11.10 ±0.71	1.24	0.324
НСТ	34.59 ± 2.96	$33.48\pm\!\!2.38$	3.78	0.042*
RBCs	$4.85\pm\!\!0.36$	4.53 ±0.48	2.01	0.06
Platelets	239.32 ±37.23	203.46 ±36.05	5.34	0.02*

Table (4): Secondary outcome among studied females

	No.	%
Further surgical intervention	0	0
Need for blood transfusion	24	100
ICU admission	0	0

DISCUSSION

The main objective of this study was to evaluate the efficacy of bilateral internal iliac artery ligation followed by Transverse B-Lynch compression suturing and intrauterine balloon tamponade as a conservative method to control placental site bleeding due to placenta praevia accreta.

Regarding demographic data, the present study goes in agreement with Sood *et al.* ⁽⁸⁾ who reported that, majority of their patients were in the age group 20-35 years and the mean maternal age at development of placenta previa was 27.9 ± 4.4 years. On the other side, Refaie *et al.* ⁽⁹⁾ and Arduini *et al.* ⁽¹⁰⁾ reported a mean maternal age of 33.59 ± 4.46 and 36.5 years respectively.

The present study agrees with Arduini *et al.* ⁽¹⁰⁾ as they reported that, the mean gravidity and parity were 2.4 and 1.1 respectively and study done by Refaie *et al.* ⁽⁹⁾ who found that the mean of gravidity was 4.02 ± 1.35 and the mean of parity was 2.74 ± 0.99 . Sood *et al.* ⁽⁸⁾ found that parity range from 2-4.

The current study coincide with Refaie *et al.* ⁽⁹⁾ who reported that, the incidence of placenta accrete in women without a history of CS was 3.9%, whereas it increased up to 15.7% in women with a history of delivery by one CS, 64.7% in women with a history of previous two or three CS. Clark *et*

al. ⁽¹¹⁾ reported that, placenta previa in women without a history of delivery by CS was 0.26%, whereas it increased up to 0.65% in women with a history of delivery by one CS, reaching 10% after four or more CS. Sood *et al.* ⁽⁸⁾ observes that 41patients had history of previous caesarean section accounting to 73.2%. History of previous one LSCS reported in 21.4 %, and previous two LSCS reported 47.4%.

In United States of America (USA), obstetric hemorrhage remains a main etiology of pregnancy-related mortality. About 29% of maternal mortalities are attributed to hemorrhage. Placenta accreta is a significant etiology of obstetric bleeding and a leading cause of peripartum hysterectomy ⁽¹²⁾.

Many procedures advanced to minimize intraoperative hemorrhage relies on the reduction of pelvic circulation, mainly of the internal iliac arteries for interruption of the arterial uterine supply with preservation of blood supply to pelvic structures and lower limbs. This has been accomplished with varying success either by transient balloon occlusion or by irreversible surgical internal iliac ligation and embolization by an interventional radiologist. Isolated case report describing the efficacy of devascularization of the arterial supply of the uterus have been published, but the procedures have not become widely popular so far⁽¹³⁾.

The current trial showed that there is no significant difference between before and after operation as regard

Hemoglobin concentration, RBCs count. However, there was significant decrease of postoperative hematocrit value. These results partially agrees with Arduini *et al.* ⁽¹⁰⁾, who reported significant decreases in hematologic parameters postoperatively.

In the study in our hands, the mean blood loss was 1459.04±121.84 ml. The surgical ligation of internal iliac artery was often used to control intractable obstetric bleeding. Therefore, a massive blood loss has actually occurred before the ability to control hemorrhage by arterial ligation. In Refaie et al. ⁽⁹⁾ study showed that early prophylactic intraoperative bilateral ligation of internal iliac artery was completed before any trial to eliminate the abnormally adherent placenta, which is the chief source of severe bleeding with massive blood loss that might happen in such a situation, a technique to decrease the pulse pressure distal to the ligation site, thus reducing blood loss during cesarean delivery in placenta accreta. It appeared to be effective in females with placenta accreta as none of these patients (n=29) required hysterectomy or suffered morbidity; however, five patients with placenta increta (5/17, 29.4%) required hysterectomy, with significant blood loss, and in one of them, maternal morbidities in the form of bladder and ureteric injury occurred.

Aggarwal *et al.* ⁽¹⁴⁾ reported huge blood loss as the main feature in all females with morbidly adherent placenta, with a mean amount of blood loss of 2710 ml, and a mean transfusion of 6 units of whole blood. Thus, internal iliac artery ligation may not only decrease blood loss but may also reduce the risk of blood transfusion reactions and transmission of blood borne infections. In contrast, Berg *et al.* ⁽¹⁵⁾ reported that internal iliac artery ligation seems to be effective control measure for bleeding due to uterine atony. However, it was less effective for placenta accreta. The efficacy of ligation is limited by quick development of an extensive pelvic collateral system.

The sole use of occlusion balloons to control hemorrhage in females with placenta accreta is even less common. Tan *et al.* ⁽¹⁶⁾ and Carnevale *et al.* ⁽¹⁷⁾ found that balloon occlusion of the main internal iliac arteries trunk was associated with reduction of intraoperative bleeding and need for transfusion when patients were retrospectively compared with a control group.

Occlusion balloons have the advantage of being completely reversible immediately after the maneuver when compared to surgical ligation of internal iliac arteries. Surgical internal iliac artery ligation needs only a professional obstetrician and just a few minutes for bilateral ligation, but preoperative balloon occlusion techniques need a team approach to patient care, and timely interventions by the interventional radiologist are crucial. Balloon access to internal iliac arteries through a bilateral common femoral artery approach was usually gained within 30 min⁽¹⁸⁾.

Preoperative prophylactic internal iliac artery embolization apparently decreases intraoperative blood loss and blood transfusion requirements in females with placenta accreta

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compared with retrospective controls. A review of the literature by Alanis *et al.* ⁽¹⁹⁾ showed arterial embolization to be effective in management of placenta increta in females who required to preserve fertility. In 72 females, a 76.9% success rate and an 11% complication rate were found. A major advantage of surgical ligation of internal iliac artery over intraoperative balloon occlusion and embolization was prevention of exposure of both the patient and the fetus to ionizing radiation, save time and team works.

Danso and Reginald ⁽²⁰⁾ **c**oncluded that intrauterine balloon catheter preceded by the B-lynch suture halted the bleeding. Success of this combined maneuver proposes its relative usefulness. One additional advantage of this combined approach was that the ability to measure the volume of blood drained into the catheter bag. The balloon in reported case was filled by 70 mL, but different volumes may be needed until bleeding stopped or was markedly decreased. Although each of the components of combined approach has been used singly in controlling postpartum bleeding, this was the first time a combination of the two procedures has been used.

Arduini *et al.* ⁽¹⁰⁾ reported that, the average blood loss was 1620 mL (range, 1100–2340 mL). Five patients needed intraor postoperative blood transfusion and the average transfused volume was 700 mL

Maher and Abdelaziz ⁽²¹⁾ found that balloon alone was successful in controlling hemorrhage in 87.5% (63/72) of their cases. This agree with the 80–90% overall success rate in the literature ⁽²²⁾. Balloon results in placenta previa yielded a great differences, with some authors reporting 100% success rates; their hypothesis was that the uterine cavity is well-contracted in cases of placenta previa, leading to more effective balloon tamponade than in cases of uterine atony ⁽²³⁾.

In conclusion, abnormal placentation such as placenta accreta or increta is a potentially life-threatening hemorrhagic states that carries a high rate of maternal complications and mortality. Prophylactic bilateral internal iliac artery ligations before extraction of placenta accrete followed by transverse B Lynch suture and intrauterine balloon tamponade appeared to be an effective and safe maneuver to reduce intra- and postpartum comorbid conditions, and to avoid emergent peripartum hysterectomy.

Conflict of interest

None

Financial disclosure:

None to be disclosed

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