

Internal iliac balloon 'catheter' with ligation or 'only ligation' for morbidly adherent placenta

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Abstract

Morbidly adherent placenta can lead to catastrophic obstetric hemorrhage accounting for between 1/3rd and 1/2 of emergency peripartum hysterectomies. When recognized antenatally, a multidisciplinary team approach with careful peripartum planning, can reduce complications.

We compared 2 patients with morbidly adherent placenta who underwent obstetric hysterectomy with IIA ligation only and the other with IIA balloon catheter with ligation. The intra & postoperative course was compared and has been described.

IIA ligation is a valuable procedure to control intractable obstetric haemorrhage. It is cost effective, doesn't require any prior extensive setup, safe and simple in practiced hands & can be of immense help in immediate control of bleeding.

Balloon catheters prophylactically in the internal iliac arteries before delivery can be done to allow obstruction of blood flow to the uterus when necessary. With balloon catheter occlusion, the balloons are in place and need only to be inflated, utilizing less than a minute's time; this can be crucial in a moment of massive hemorrhage.

Keywords: Morbidly adherent placenta, Balloon catheters, Internal iliac ligation.

Case History 1: (with Balloon Catheter)

A 28-year-old woman, G3P1L1A1 with h/o previous LSCS with gestational age of 37 weeks was admitted for safe confinement. An elective LSCS was planned for her in view of previous LSCS with the prenatal ultrasound suggestive of complete placenta praevia with multiple vascular channels/lacunar spaces extending into the bladder serosa. The present pregnancy was uneventful till the day of presentation. She had a significant obstetric history of abruptio placenta in her prior pregnancy delivered by emergency caesarean section. This was followed by a missed abortion which necessitated a dilatation and curettage.

An elective caesarean delivery was planned with prophylactic bilateral internal iliac artery Fogarty balloon catheter insertion by access through bilateral femoral arteries with the services of an interventional radiologist in cardiac cath lab under fluoroscopic guidance. (Fig. 1-4)

Patient was shifted to main operation theatre where caesarean section was performed under general anaesthesia. The lower segment was replaced with the placental bed and the delivery was achieved by cutting through the placenta. A healthy baby boy weighing 2790-g was delivered. The balloon catheters were then inflated. The placenta was morbidly adherent in the lower uterine segment anteriorly. The placenta could not be removed completely with gentle traction as no plane of separation could be identified between the placenta and the uterine wall. Due to continuous bleeding from the placental bed, immediate decision was taken to proceed with caesarean hysterectomy during which it was observed that the lower uterine segment was adherent to the bladder wall. An inadvertent injury was noted at the dome of the bladder about 5 cm in size. The

hysterectomy was completed by serially applying clamps, cutting and ligating the pedicles. Linen was used except at the uterines and the vault closure to achieve better haemostasis.

Since the Fogarty balloon cannot be left in situ for a long time it was decided to proceed with internal iliac ligation. The balloons were first deflated and then the internal iliac arteries were doubly ligated with linen.

Except for the rent, the rest of the bladder mucosa was found to be normal and intact. Intraoperatively, the urologist was consulted. Both the ureters were traced completely and were found intact with normal muscular peristalsis. The rent on the bladder was sutured in two layers –first interrupted and then second in continuous running sutures. The omentum was sutured over the repaired bladder rent. The abdomen was closed in layers and an abdominal drain was kept in situ.

The sheaths of the artery catheters were removed, manual deep compression was applied to achieve hemostasis and compression bandage dressing done. After extubation, however patient complained of severe pain in right lower limb. On examination, the peripheral pulsations (dorsalis pedis) and saturation could not be recorded in right lower limb. An emergency angiography was done after consulting the cardiovascular-thoracic surgeon which showed presence of thrombosis in right common iliac artery. (Fig. 5)

The Fogarty balloons were deflated and internal iliacs ligated almost simultaneously. It is possible that the combination of ligation and balloon inflation led to mucosal trauma which caused thrombus formation extending into the right common iliac artery. Decision was taken to proceed with an emergency embolectomy after consulting vascular

surgeon. A Fogarty no 5 catheter was used to remove the thrombus by approaching via a puncture through the right femoral artery to the common iliac artery. Femoral artery was sutured. Good peripheral flow and pulsations were established and confirmed after the embolectomy procedure.

The patient was then shifted to the intensive care unit for the next 72 hours. The rest of the postoperative course has been described in Table 1.

Final Histopathology report confirmed chorionic villi infiltrating full thickness of the myometrium with no decidual tissue identified at the interface, thus consistent with Placenta Percreta.



Fig. 1: Tip of catheter in distal common iliac artery



Fig. 2: Tip of catheter in distal common iliac artery



Fig. 3: Balloon in Internal iliac artery



Fig. 4: Catheters in bilateral internal iliac arteries



Fig. 5: Right common iliac artery thrombus

Table 1: Comparison

Parameters	Balloon catheter insertion with internal iliac artery ligation	Internal iliac artery ligation
Intraoperative vitals	Stable	Noradrenaline support required for hypotension @ 4ml/hour
Blood products	4 PRBC ^I , 6 FFP ^{II}	4 PRBC, 4 FFP
Crystalloids	3000 ml	3500 ml
Colloids	500 ml	1500 ml
Blood loss	2100 ml	3500 ml
Post-operative ICU ^{III} stay	72 hours	48 hours
Drain output	700 ml in first 48 hours	1100 ml in first 48 hours
Intraoperative & postoperative complications	Bladder injury Right common iliac artery thrombosis	Bladder injury
Additional intervention	Embolectomy required	Nil
Haemoglobin	Pre-operative-12.5 g/dl Post-operative-8.2 g/dl	Pre-operative-11.4 g/dl Post-operative-8.0 g/dl
Anti-thrombotic therapy	Low molecular weight heparin Warfarin Physiotherapy	Physiotherapy
Mobilization	Pod ^{IV} 3	Pod 4
Shift to ward	Pod 4	Pod 4
Drain removal	Pod 10	Pod 6
Catheter removal	Pod 14	Pod 10
Discharge	Pod 10 with catheter	Pod 10
Any post discharge complications	Nil	Nil

I-Packed Red blood cells

II- Fresh frozen plasma

III-ICU-Intensive Care Unit

IV-Pod- Post operative day

Case History 2: (with Internal Iliac Artery Ligation)

A 27-yr old woman, G3P1L1MTP1 with previous scar at 37 weeks of gestation was admitted for safe confinement in view of MRI suspecting placenta accreta? percreta?. An elective caesarean section was planned for her with consent taken for internal iliac artery ligation and emergency obstetric hysterectomy in case of severe haemorrhage. She had a history of PROM in previous pregnancy followed by an emergency caesarean section and required blood transfusion intraoperatively. This was followed by medical abortion a year later. She had an episode of bleeding per vaginum in her present pregnancy at early gestational age which was managed conservatively. She was also a known case of hypothyroidism.

Patient was shifted to main operation theatre for elective surgery under general anaesthesia. Using a pfannenstiel incision, a healthy male baby weighing 3300 gms was delivered. The placenta was found to be anterior, low lying completely adherent to the myometrium. In order to contain the severe bleeding from the placenta, as a primary surgical intervention, bilateral internal iliac artery ligation was done. The retroperitoneal space was entered at the level of bifurcation of common iliac to the point of division into the external and internal iliac arteries. The ureter was retracted medially by gentle finger dissection. The fat and loose connective tissue around the IIA and vein were removed and a right-angle vascular clamp was passed beneath the IIA from the lateral to the medial side approximately 3-4 cm distal to its origin. Using an

absorbable suture, the IIA was ligated doubly. Pulsations of the external iliac and femoral arteries were identified after internal iliac ligation. The procedure was then repeated on the other side.

Decision was taken to proceed with obstetric hysterectomy as the placenta would not separate without causing torrential haemorrhage. During hysterectomy, while separating the utero-vesical fascia, an inadvertent injury was seen on bladder dome about 2 cm in size. Bilateral ureters were traced too for peristalsis. Integrity of Bilateral external iliac arteries was confirmed by palpation of dorsalis pedis arteries on both sides. The bladder injury was repaired in continuous sutures. All pedicles and vault were checked for hemostasis. A pelvic drain was kept in situ and abdomen was closed in layers.

Intraoperatively, she required inotropic support of noradrenaline at 4ml/hour due to hypotension induced by the blood loss. She was shifted to the intensive care unit after extubation for the next 48 hours for observation and close monitoring. Drain output was 700 ml after 24 hours, 400 ml after 48 hours, 150 ml after 72 hours. Urine cleared 4-6 hours after the surgery and output was well maintained at 100-150 ml per hour. Blood pressure stabilized and noradrenaline support was tapered gradually after 36 hours and stopped. Tachycardia persisted for 72-96 hours. Patient was conscious throughout after the surgery and bowels were opened on post-operative day 4. Breast feeding was started on day 4 post op. All other details have been compared in Table 1.

Histopathology report revealed Placenta Percreta with accelerated villous maturation, intervillous thrombosis with no evidence of gestational trophoblastic disease, villitis or chorioamnionitis.

Review of literature

The incidence of abnormal placentation has increased with the increasing rate of caesarean deliveries. Recent estimates suggest that from one in 2500 to as many as one in 500 pregnancies are complicated by abnormal placentation.^{3,4} The risk of abnormal placentation increases with the number of prior caesarean deliveries. The risk of abnormal placentation was 3% for the first caesarean delivery in the study by Silver et al. increasing to 40% for the third and 67% for the fifth such delivery.⁵

An abnormal attachment of the placenta to the myometrium leads to failure of complete placental detachment after delivery and subsequent uterine bleeding or retained products of conception. Invasion of the placenta into adjacent organs such as bladder, bowel, and ureter can cause injury in these structures.

The placenta praevia and accreta are conditions of abnormal placentation, in which the villus sampling invade the myometrium at the site of implantation and is associated with the partial or complete absence of the decidua. The proposed contributing factors in development of abnormal placentation include deficient decidualization, excessive trophoblast invasion, local differences in oxygen tension, abnormal vascular remodeling, or a combination of the above.^{3,6} The most commonly cited clinical risk factors include previous caesarean delivery, placenta praevia, previous uterine surgeries like a myomectomy or curettage, and advanced maternal age.^{5,7} Placental location seems to have a significant impact.⁵ The lower uterine segment decidua is poorly developed as compared to the rest of the uterus, which may contribute to the association between abnormal placentation and low-lying placenta (9.3% incidence with previous scar). Placental implantation over a prior uterine scar also has a relatively high association with abnormal placentation. Morbidly adherent placenta in locations, such as the uterine fundus, can be associated with prior uterine procedures, such as myomectomy or surgical correction of mullerian anomalies.⁸

Antenatal diagnosis of abnormal placental attachment can reduce delivery complications and blood loss. It can be done by elicitation of history & suspecting risk factors and through prudent ultrasound evaluation of the placenta at the time of obstetrical screening for anomalies done routinely at approximately 18-20 weeks of gestational age.⁹ A multidisciplinary team approach is required. This includes special expertise in high-risk obstetrical care and gynecologic oncology and to seek the services of urologist, radiologist (including interventional radiology), obstetric anesthetist, and preoperative blood and blood products banking. This along with careful peripartum planning, can reduce maternal morbidity.¹⁰

Definitive therapy is a pre-planned obstetric hysterectomy when abnormal placentation is suspected

antenatally, although it may not be required or desirable in every case. Multiple current therapeutic options exist. Surgical removal of the placenta is often undertaken with subsequent hysterectomy, but surgical management carries a high risk of bleeding.

Conservative approaches exist to preserve fertility or avoid extensive bladder injury and subsequent reconstruction. The least invasive approach is to leave the placenta in situ post-delivery and allow for spontaneous regression or subsequent administration of methotrexate. Others include segmental myometrial resection^{10,11} or catheter-directed arterial embolization. However, if the placenta is low lying and one has to go through the placenta to deliver the baby these options are difficult to adopt. Some do advocate a classical caesarean section so that the placenta is not disturbed.

Most important is achieving rapid hemostasis. Collateral blood supply of the female pelvis may create problems in achieving adequate hemostasis. Intraoperative ligation of the internal iliac or uterine arteries or preoperative catheterization with intraoperative balloon occlusion of the internal iliac arteries are current methods employed to control intraoperative bleeding.

Internal Iliac Artery (IIA) ligation can be employed prophylactically in cases of anticipated severe haemorrhage. At times during ligation, visualization of the vessels can become tedious due to the excessive hemorrhage. It can be practically difficult due to distorted anatomy due to abnormal placentation. A meticulous understanding of retroperitoneal anatomy is needed to decrease the rate of complications.

IIA is a retroperitoneal structure that enters medioinferiorly into the pelvic fossa after originating from common iliac artery. The ureter crosses at the bifurcation from lateral to medial at the bifurcation of common iliac arteries. The IIVein lies posteromedial to the IIA. IIA ligation helps reducing the pulse pressure that helps in stabilizing clot formation. After ligation, circulation in the parts supplied by the internal iliac artery would be carried on by the anastomosis between the following arteries: uterine and ovarian arteries; the middle and superior vesical arteries; the iliolumbar and the last lumbar and the lateral sacral with the middle sacral arteries.

Collaterals develop 45-60 minutes after ligation and blood flow gradient is significantly reduced due to smaller diameter. The arterial system gets converted to venous like system. Unilateral ligation of the internal iliac artery, decreases the pulse pressure distal to point of ligation by 77%, while bilateral ligation by 85%. It is desirable to ligate the main trunk to decrease the operative time. Care should be taken not to transect the vessel. Ureters, External/Common Iliac Artery, any bleeding from venous plexuses should be checked for.

Complication rate is less than 1-9% depending on surgical competency and patient hemodynamics. Possible ones are External Iliac Artery spasm/thrombosis; injury to Internal/External Iliac Vein, ureter/External or Common Iliac Artery ligation, necrosis of buttocks/perineum/bladder

mucosa, atonic bladder, injury to bladder/rectum, circulatory disturbances of lower extremities. Failure could be due to aberrant vessels, clot dislodgement, concomitant venous bleeding, vessel necrosis, DIC, refractory coagulopathy, severe hypovolaemic shock.^{12,13}

Embolization or balloon catheters¹⁴⁻¹⁶ placed preoperatively in the internal iliac arteries before delivery can be done to allow obstruction of blood flow to the uterus when needed. With balloon catheter occlusion, the balloons are in place and need only to be inflated, utilizing less than a minute's time; this can be crucial in a moment of massive hemorrhage. Because delay is eliminated, it is presumed that the blood loss will also be limited. Preoperative placement of balloon occlusion catheters also allows for intraoperative Gelfoam embolization if necessary. The technique reduces the pulse pressure as described, thus minimizing blood loss. However, the advantages of this technique over hysterectomy alone have been questioned with respect to outcome, and it is not without risk of vascular complications such as femoral/popliteal artery thrombosis, iliac artery thrombosis/ dissection, groin hematoma.

Possible contributing factors included those related to technique, such as operator experience, duration of catheter placement procedure, number of attempts, and inadvertent luminal endothelium trauma. Other inherent risk factors include genetic predisposition to thrombosis by a mutation in an undetermined factor, hemodynamic instability and presence of coagulopathy or its aggressive correction with inappropriate blood transfusion. The hypercoagulable state of pregnancy and the vascular wall remodeling of arteries in pregnant women increases the risk of a thromboembolic event, also enhances the complication and susceptibility of dissection.

Prolonged catheterisation is a significant contributing factor to vascular complication, and early device removal has been recommended. Currently there is no definitive guideline for determining the duration of inflation and the appropriate time for device removal. The most important instruction given to the patients during the period of device placement is to keep the lower extremities strictly immobilized.

Temporary balloon occlusion of the internal iliac arteries is a reasonable substitute for control of bleeding in patients at high risk of obstetric hemorrhage, if performed by an experienced team and at centres with sophisticated arteriographic imaging facilities available.

IIA ligation is a valuable surgical procedure to control intractable obstetric haemorrhage. It can also be used in gynaecological surgeries with severe haemorrhage. Advantages are that it is cost effective and does not require any prior extensive setup. But it requires expertise with retroperitoneal anatomy and good surgical skills so as to decrease the chances of intraoperative and postoperative complications. It is a safe and simple surgical procedure in practiced hands and if learnt well, can be of immense help in cases of immediate control of bleeding.

Conflict of Interest: None.

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