Prophylactic bilateral internal iliac artery balloon occlusion in the management of placenta accreta: A 36-month review

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ABSTRACT

Background: The contemporary obstetrician is increasingly put to the test by rising numbers of pregnancies with morbidly adherent placenta. This study illustrates our experience with prophylactic bilateral internal iliac artery occlusion as part of its management.

Methods: Between January 2011 to January 2014, 13 consecutive patients received the intervention prior to scheduled caesarean delivery for placenta accreta. All cases were diagnosed by ultrasonography, color Doppler imaging and supplemented with MRI where necessary. The Wanda balloon™ catheter (Boston Scientific, Natick, MA, U.S.A) were placed in the proximal segment of the internal iliac arteries preceding surgery. This was followed by a midline laparotomy and classical caesarean section, avoiding the placenta. Both internal iliac balloons were inflated just before the delivery of fetus and deflated once haemostasis was secured. Primary outcomes measured were perioperative blood loss, blood transfusion requirement and the need for ICU admission.

Results: The mean and median intraoperative blood loss were 1076mls±707 and 800mls (300-2500) respectively while mean perioperative blood loss was 1261mls±946. Just over half of the patients in our series required blood and/or blood products transfusion. Two patients (15.4%) required ICU admission.

Conclusion: Our study suggests that preoperative prophylactic balloon occlusion of bilateral internal iliac arteries reduces both blood loss and transfusion requirement in patients with placenta accreta, scheduled to undergo elective caesarean hysterectomy. It is an adjunct to be considered in the management of a modern day obstetric problem, although the authors are cautious about generalizing its benefit without larger, randomized trials.

KEY WORDS:
Internal Iliac artery occlusion; balloon occlusion; placenta accreta, morbidly adherent placenta; postpartum haemorrhage; caesarean hysterectomy

INTRODUCTION

Placenta accreta is the abnormal adherence of the placenta to the uterine wall and depending on the degree of invasion into the myometrium, is classified as placenta accreta vera, percreta, or increta. The incidence is about 1 in 500 but is a life-threatening condition with a maternal morbidity rate of 7%. Approximately 90% of patients required blood transfusion and significantly, just under half who were transfused required more than 10 pints of packed red cells.[1,2] With many countries around the world reporting an increasing rate of caesarean sections, this condition is indeed worrying and expected to rise.

The jury is still out on the optimal management of placenta accreta but the majority of cases would involve a caesarean hysterectomy, which is considered the current standard treatment.[2,3] In fact, it has been reported that up to two in five peripartum hysterectomies are related to placenta accreta.[4] Large amount of intraoperative blood loss is common (3000mls or more) and many techniques therefore, have been developed to address this.[5]

Prophylactic balloon occlusion of the internal iliac arteries as an adjunct was first described by Dubois and since then, has resulted in mixed outcomes in patients diagnosed with placenta accreta, making it a controversial procedure.[6,7] The advantages of this technique are a reduction in blood loss and improved visualization of the surgical field, until haemostasis is achieved or hysterectomy performed. Intrapartum and postpartum haemorrhage could be also prevented, hence reducing the need for transfusion. Despite the purported benefits, the procedure has been marred by serious complications.

The objective of this study is to illustrate our experience with the prophylactic use of balloon occlusion of the internal iliac arteries as part of the management of placenta accreta.

MATERIALS AND METHODS

In this single-centre, retrospective observational study, we report the results of 13 consecutive cases of placenta praevia accreta vera, increta and percreta from January 2011 to January 2014. In each case, balloon occlusion of internal

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iliac arteries was performed prophylactically rather than with a therapeutic intent.

For the purpose of description, the term "placenta accreta" is used to represent all types of morbidly adherent placenta. As of January 2011, it was the policy of the Department of Obstetrics and Gynaecology, Sarawak General Hospital to routinely manage antenatally diagnosed placenta accreta with balloon occlusion and operative delivery. Diagnosis of such cases was achieved by ultrasonography and color Doppler imaging by a consultant fetomaternal specialist. Where deemed necessary, this was supplemented with a pelvic magnetic resonance imaging (MRI). All patients were scheduled for elective caesarean section and provided informed, written consent for all procedures mentioned.

A credentialed, lead consultant interventional radiologist performed catheterization and placement of the internal iliac balloons prior to transfer to the operating theater. All cases were either performed by the aforementioned consultant or by his assistant with his direct involvement.

The initial arterial access to both the common femoral arteries was via percutaneous Seldinger technique under local anesthesia. The Wanda Balloon™ is a percutaneous transluminal angiography (PTA) balloon catheter designed to allow rapid inflation-deflation when indicated. Sizes between diameters of 5mm to 10mm and lengths of 40mm and 80 mm were utilized depending on the radiologist's discretion. The balloons were placed in the most proximal segment of the internal iliac arteries, through crossover sheaths between sizes of 5F to 8F from the contralateral common femoral artery. Fluoroscopy with diluted contrast medium was used to guide and confirm placement (Figure 1 and 2). The Encore 26™ inflator syringes were then attached to both catheters. Both sheaths and balloon catheters were anchored with skin suture and taped with adhesive dressing to avoid displacement and further use of fluoroscopy during caesarean section. With the arterial sheaths and balloon catheters secured in place, patients were transferred to the operating theatre.

General anaesthesia was universally administered to patients, midline laparotomy performed and both internal iliac balloons inflated just before uterine incision. Classical caesarean section was the uterine incision of choice to avoid the main bulk of the placenta and baby delivered. There was no attempted placental removal in all cases and hysterectomy was not performed if the placenta spontaneously separates, unless complicated by massive haemorrhage. All cases of caesarean section were performed by a lead consultant obstetrician with at least 10 years of experience.

Pressure on the internal iliac balloons were monitored via the pressure gauge on the Encore 26™ during surgery by the radiology team. Once haemostasis was secured, both internal iliac balloons were deflated and observed for any further bleeding. At this point, the surgeon may elect to proceed with bilateral internal iliac ligation by withdrawing the Wanda balloons™, if haemostasis was deemed inadequate. Alternatively, the balloons were reinflated and bilateral uterine artery embolization undertaken by the radiologist. Neither of the procedures were mandatory. Femoral sheaths were removed within 12 hours of surgery when risk of bleeding was deemed to be reduced.

Perioperative blood loss was estimated by summation of the volume in suction canisters, visual estimation of vaginal blood loss and weighing of swabs and abdominal packs. Perioperative blood loss included the blood loss at initial surgery, relaparotomy if required and anytime in between the operations until discharge. The primary outcome was perioperative blood loss, blood transfusion requirement and the need for ICU admission.

Cases were identified using the Internal Iliac Balloon Catheter Registry and counter-checked with logged internal iliac balloon occlusion procedures kept by the Department of Radiology. Case notes were reviewed and desired information collected using a standardized proforma. Exclusion criteria included cases of undiagnosed placenta accreta or use of prophylactic internal iliac artery balloon occlusion in non-accreta obstetric cases.

Descriptive statistical analysis was performed for demographic data using SPSS version 19 (IBM, Armonk, NY, U.S.A)

Institutional and Malaysian Research and Ethics Committee approval was obtained (NMRR ID 14-363-20134).

RESULTS

Patient demographics are shown in Table I. Fourteen patients underwent prophylactic balloon occlusion procedure during the period of study. There were eleven patients diagnosed antenatally as placenta praevia accreta and of these, placenta increta was also noted in six patients while two patients had a diagnosis of percreta. One patient was diagnosed to have placenta praevia but with no antenatal ultrasonography evidence of accreta. As such, only thirteen patients were suitable for inclusion in the study.

All except three patients were delivered at term. In these three patients, the decision for earlier intervention was because of concomitant intrauterine growth restriction, severe pre-eclampsia with oligohydramnios and MRI study showing placenta tissue invading into the small bowels, respectively. All patients had at least one previous caesarean section. From the thirteen patients whom were suspected to have placenta accreta, nine were confirmed clinically and with histological examination whilst the remainder were placenta praevia, based on complete intraoperative separation of placenta. Four patients had caesarean section and the rest had caesarean hysterectomy (9/13, 69.2%). Of the four who did not require caesarean hysterectomy, two patients had placenta praevia whilst the other two were suspected of having bowel and bladder involvement respectively. In the latter cases, the placenta was left in-situ and prophylactic broad-spectrum antibiotics were commenced. The patients were followed up with serial BHCG, Doppler ultrasound and placental volume until expulsion of residual placental tissue. Both patients did not eventually require hysterectomy.

Table I: Patient Demographics

Patient No.	Age (years)	Gravida	Parity	No. of previous Cesarean	No. of previous curettage
1	28	3	2	2	0
2	40	4	3	1	0
3	35	3	1	1	1
4	34	3	2	2	0
5	25	3	2	1	0
6	44	9	7+1A	2	0
7	32	3	2	2	0
8	32	5	3+1A	3	0
9	23	4	2+1A	1	0
10	33	3	2	1	0
11	32	4	3	1	0
12	37	4	2+1A	2	1
13	31	4	2+1A	1	1

A= miscarriage; Curettage=any form of surgical evacuation of retained products of conception

Table II: Details of procedure and individual outcomes

Patient no.	Diagnosis (HPE)	Procedure	Length of surgery (min)	Blood Loss (mls)	Pack cell transfused (pints)	ICU Admission (days)
1	No accreta	Caesarean hysterectomy for atony + Prophylactic bilateral internal iliac ligation	168	2500	7	2
2	Percreta	Caesarean section + Placenta left in-situ	100	300	1	0
3	Increta	Caesarean hysterectomy + Prophylactic bilateral internal iliac ligation	116	600	0	0
4	Percreta	Caesarean section + Placenta left in-situ	92	300	0	1
5	Increta	Caesarean hysterectomy + relaparotomy + bilateral internal iliac ligation	160	1600	4	0
6	No accreta	Caesarean hysterectomy for atony + relaparotomy + bilateral internal iliac ligation	135	1500	6	0
7	Accreta vera	Caesarean hysterectomy	135	700	0	0
8	Increta	Caesarean hysterectomy	140	700	0	0
9	No accreta	Caesarean section	71	400	0	0
10	No accreta	Caesarean section	75	1700	1	0
11	Increta	Caesarean hysterectomy + Prophylactic bilateral internal iliac ligation	182	800	4	0
12	Increta	Caesarean hysterectomy	110	900	0	0
13	Increta	Caesarean hysterectomy	95	2000	2	0

HPE= histopathological examination; ICU=intensive care unit; min=minutes; mls=mililitres

Three patients had bilateral internal iliac artery ligation performed at initial surgery and the remaining two patients were during relaparatomy. Suspected intra-abdominal bleeding was the reason for relaparotomy and intraoperative findings were that of bleeding from the right ovarian pedicle and vault as well as a vault haematoma. All the cases with bilateral internal iliac ligation had caesarean hysterectomy.

Mean estimated blood loss was 1261mls±946 (range; 300mls to 2900mls) . When cases of non-accreta were excluded, the mean blood loss was 1185 mls±786 (range; 600mls to 2600mls).

Seven patients (53.8%) were transfused with blood (ranging from 1 pint to 7 pints of blood) and out of this, only three patients required additional blood products, namely fresh frozen plasma or platelets concentrates. One of the seven patients had blood transfusions despite only 300mls of blood loss. This was a case of placenta percreta and was transfused on day 2 postoperatively due to anticipation for relaparotomy. The patient had abdominal distention, tachycardia and some amount of free fluid was seen in the paracolic gutters. However, the haemoglobin at that point was merely lower by 0.8g/dL at 9.2g/dL, compared to the preoperative haemoglobin. The amount of blood loss for the remaining 7 patients were 300mls, 800mls, 1500mls, 1600mls, 1700mls, 2000mls and 2500mls respectively.

Postoperative uterine artery embolization (15.4%) was carried out for both cases with placenta percreta. Two patients required ICU admission due to massive postpartum haemorrhage but in both instances they were discharged within 48 hours.

DISCUSSION

The main finding of this retrospective observational study suggests that the use of prophylactic bilateral balloon occlusion of the internal iliac artery is associated with a reduction of intraoperative blood loss, blood transfusion requirement and the need for ICU admission.

Table III : Composite patient outcomes

Variable	Mean values (N=13)
Surgical procedure	
Hysterectomy	9 (69.2%)
Local resection	0 (0.0%)
Placenta retained in-situ	2 (15.4%)
Bilateral internal iliac ligation	
Prophylactic	3 (23.1%)
During re-laparotomy	2 (15.4%)
Subsequent coil embolization of both internal iliac	2 (15.4%)
Intraoperative blood loss (mls) (mean, SD)	1076± 707
Total blood loss, including relaparotomy (mls) (mean, SD)	1261±946
<500	3 (23.1%)
500-1000	5 (38.5%)
>1000	5 (38.5%)
Transfusion	Any transfusion 7/13 (53.8%)
Packed red blood cells (pints) (mean, SD)	2.2±2.4
No. (%)	7/13 (53.8%)
Fresh frozen plasma (units) (mean, SD)	0.8±1.5
No. (%)	3/13 (23.1%)
Platelet (units) (mean, SD)	0.6±1.5
No. (%)	2/13 (15.4%)
Median length of surgery (min) (range)	116 (71-182)
Median length of hospitalization after surgery (days) (range)	5 (2-39)

CI=confidence interval; min=minutes; mls=mililiters; SD=standard deviation

Fig. 1: Before occlusion of internal iliac artery.

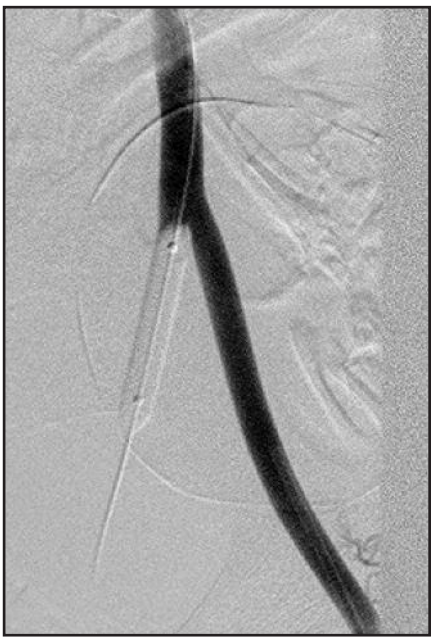

Fig. 2: After occlusion of internal iliac artery.

Some investigators have concluded that prophylactic intravascular balloon catheters did not benefit women with placenta accreta undergoing caesarean hysterectomy,[7] while others have demonstrated reduced intraoperative blood loss and blood transfusion requirements.[5,8] In addition, a retrospective evaluation showed no statistical significance in intraoperative blood loss with balloon occlusion followed by embolization prior to hysterectomy in patients with placenta accreta/percreta.[9]

In almost two thirds of cases in our series, blood loss was less than 1000mls, the commonly accepted level for postpartum haemorrhage. Mean perioperative blood loss of 1261mls compare favourably with the estimated blood loss of 1671mls and 2011mls reported by Carnevale et al. and Tan *et al.* respectively.[5,8] In the latter, blood loss in the control group was actually 39.4% more at 3316mls (range 1000-4000mls).[5] Although there is an absence of a control group in our series, as all cases of placenta accreta suspected antenatally were managed during the study period as described above, our mean estimated blood loss was still lower than previously reported findings.[10] The estimated blood loss in simple caesarean section without abnormal placental abnormality is about 1000ml,[10] whilst that of placenta accreta has been quoted as between 3000ml to 5000ml.[11]

In a review of cases of placenta percreta, mean intraoperative blood loss was closer to 4000mls, although in that paper, surgical approach after balloon occlusion differed from ours.[12] Presence of collateral vessels in the gravid uterus could explain some failures of occlusive balloons and overall blood loss could be contributed by collateral circulation from cervical, ovarian, rectal, femoral, lumbar and sacral arteries.[2] Both our patients with placenta percreta did not have primary or secondary postpartum haemorrhage despite leaving the placenta in-situ. However, the authors are aware that no meaningful conclusion can be derived from these two cases alone.

There are suggestions that occlusion of the common iliac vessels may be a better option to reduce the amount of blood loss, by additional blockage of the supply from the external iliac vessels.[12] In this study, the occlusions of the proximal portion of the internal iliac seem equally effective in reduction of blood loss.

53.8% of patients required transfusion and this was lower than 73% reported in a population-based descriptive study.13 It has also previously been quoted that up to 90% of patients with placenta accreta require blood transfusion and 40% require more than 10 units of packed red blood cells.[1]

This may be subjected to bias and could depend upon the discretion of the surgeon. As with our series, the decision to transfuse blood was not only the intraoperative blood loss but also depended on the clinical findings. One patient with placenta percreta involving the bowel bowel was transfused despite a blood loss of only 300mls in anticipation for relaparotomy. This was one of the earliest cases managed in our centre and may reflect some degree of over-vigilance.

Antenatal diagnosis of placenta accreta/percreta is associated with reduced levels of blood loss and a reduced need for blood transfusion.[13,14,15] All the patients in this series were diagnosed with ultrasonography alone or coupled with MRI evaluation antenatally. Elective surgery was less likely to require blood transfusion and had less intraoperative blood loss.[15] Antenatal diagnosis allowed for a systematic planning either by performing a caesarean hysterectomy or leaving the placenta in-situ. 69.2% of patients underwent peripartum hysterectomy but there were only 38.5% where the total blood loss was more than 1000mls.

There were no reported complications associated with the use of balloon catheters in our case series. Some investigators have reported acute limb ischaemia secondary to popliteal arterial thrombus, extensive haemorrhage leading to perioperative hypovolaemic cardiac arrests and a case reportedly had bilateral pseudoaneurysms.[2,16,17] Overall surgical complications associated with the use of prophylactic balloon occlusion of the internal iliac arteries ranged between 6 to 15% that include puncture site haematomas, dissection of femoral arteries, air in pressurized lines, symptomatic hypotension, ureter and bowel injury.[7,18]

However, our observations showed that prophylactic balloon occlusion of the iliac arteries does not prevent caesarean hysterectomy similar to a review article by Dilauro.[2] About two-thirds of our cohort group had a caesarean hysterectomy. This may have been biased by the initial surgeon's decision for caesarean hysterectomy prior to deliver and may not have been based on the intraoperative findings or the amount of blood loss. Nonetheless, two patients had concurrent hysterectomy because of atonic uterus.

Questions surrounding maternal and fetal radiation exposure would undoubtedly arise during treatment. Clinicians should be familiar with basic radiological principles and be ready to discuss this with patients. Deterministic side effects (fetal growth restriction, malformation, mental retardation) are no longer a major concern for the term fetus. Mean fetal radiation dose of 4.4mGy has been reported, conferring an additional 0.002-0.02% risk of childhood cancer.[19,20]

Limitations of this study include its single arm evaluation and include those inherent to retrospective observational studies. From January 2011, our centre's policy meant that scheduled caesarean section was performed for placenta praevia accreta, with the use of prophylactic balloon occlusion. As a result, there was no control group for which we can compare the results with. Ethical concerns may arise if we were to revert to caesarean section alone, for the sole intention of allowing a control group, unless there is a change in policy for service provision backed by sound evidence.

With a limited number of patients in our series, the authors are cautious about generalization of its benefits. However, in cases which are rare such as these, it may take many more years before adequate numbers can be recruited and analysed. Relying on operative notes to obtain information

on blood loss that could lead to underestimation. Indeed, estimation of blood loss is subjective but in our study, attempts to objectively quantify the blood loss through weighing of available swabs and gauze in addition to visual estimation were documented.

To our knowledge, our case series is the first to be written locally. This procedure is only feasible in a tertiary centre with supportive interventional radiologists. Centralization of services and having dedicated regional centres for such procedures may be the key to improving outcomes. More importantly, obstetricians should strive towards the safe prevention of primary caesarean section, to reduce the incidence of subsequent caesarean sections and placenta accreta.

Future studies to evaluate this technique should include patients whom have scheduled caesarean hysterectomy without the use of prophylactic bilateral balloon occlusion of the internal iliac arteries. Comparisons between the surgical approach in our review and Triple-P procedures may also offer a better insight.

CONCLUSION

Our study suggests that preoperative prophylactic balloon occlusion of bilateral internal iliac arteries reduces both blood loss and transfusion requirement in patients with placenta accreta, scheduled to undergo elective caesarean hysterectomy. It is an adjunct to be considered in the management of a modern day obstetric problem, although the authors are cautious about generalizing its benefit without larger, randomized trials.

CONTRIBUTION TO AUTHORSHIP

TYL initiated the review, drafting of the initial manuscript and was involved in data analysis
HS was continuously involved in the revision of the manuscript and provided approval for the final manuscript
NLLJ acquired, analysed and interpreted the data
VHY drafted the manuscript, acquired, interpreted the data and is responsible for the final manuscript.

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