

Placenta Accreta: Comparison of Cases Managed With and Without Pelvic Artery Balloon Catheters

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Objective: To describe our experience with the use of prophylactic pelvic artery balloon catheters in cases of placenta accreta diagnosed by antenatal ultrasound and to compare these cases with contemporary controls.

Methods: In this prospective study, all patients seen at our institution between January 1994 and August 1997 with the antenatal sonographic diagnosis of placenta accreta were offered prophylactic preoperative pelvic artery balloon catheterization. Patients who were delivered by cesarean hysterectomy for unsuspected placenta accreta in our institution during the same time interval served as controls. Five patients with the sonographic diagnosis of placenta accreta underwent prophylactic pelvic artery balloon catheterization. Surgical outcomes in patients who received balloon catheters were compared with those managed without them. Statistical analysis was performed using the Mann-Whitney U test.

Results: Five patients with placenta accreta or one of its variants were correctly identified with antenatal ultrasonography. Of the five patients who underwent pelvic artery balloon catheterization, all had placenta accreta and four required cesarean hysterectomy. The mean estimated blood loss, transfusion requirement, and length of hospitalization in patients undergoing hysterectomy managed with and without the balloon catheters was not different ($P > 0.06$).

Conclusions: Antenatal sonographic diagnosis of placenta accreta enables preoperative planning. In our experience, use of pelvic artery balloon occlusion catheters in patients requiring a cesarean hysterectomy for placenta accreta did not improve surgical outcomes compared with patients managed without them. These preliminary findings are based on a small number of patients; therefore, further investigation is needed. *J. Matern.-Fetal Med.* 1999;8:173-176. © 1999 Wiley-Liss, Inc.

Key words: balloon catheters; placenta accreta

INTRODUCTION

Obstetric hemorrhage is the leading cause of maternal mortality in the United States [1] with postpartum hemorrhage responsible for approximately one-third of maternal deaths due to bleeding [2]. Cesarean hysterectomy is considered the definitive therapy for a patient with life-threatening postpartum bleeding of uterine origin which is unresponsive to medical or less aggressive surgical treatments.

Recently, placenta accreta has emerged over uterine atony as the leading indication for peripartum hysterectomy [3]. This finding probably reflects the increased proportion of obstetric patients with prior cesarean deliveries, a known risk factor for placenta accreta. Additional risk factors for placenta accreta include placenta previa, previous uterine surgery, and multiparity. It has been established that pa-

tients with placenta previa and a history of one or more prior cesarean deliveries are at significantly increased risk for placenta accreta [4,5].

Ultrasonography has been used in the antenatal diagnosis of placenta accreta [6,7]. Preoperative recognition of this pathologic condition enables planning for a hysterectomy and postpartum hemorrhage. Recently, in our institution we attempted to decrease blood loss and facilitate surgery by preoperative placement of occlusion balloon catheters in the pelvic arteries of patients with the sonographic diagno-

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sis of placenta accreta. The purpose of this study is to describe our experience with the use of prophylactic balloon catheters in patients with suspected placenta accreta and to compare these cases to patients with placenta accreta diagnosed at surgery.

SUBJECTS AND METHODS

In this prospective study, all patients seen at our institution between January 1994 and August 1997 with the antenatal sonographic diagnosis of placenta accreta were offered prophylactic preoperative pelvic artery balloon catheterization. Patients who were delivered by cesarean hysterectomy for unsuspected placenta accreta during the same time interval served as controls. Ultrasound examinations were performed on all patients in the second and/or third trimester using Acuson 128 (Acuson, Mountain View, CA), General Electric Logic 400 (GE Medical System, Milwaukee, WI), or Ultramark 9 (Advanced Technology Laboratories, Bothell, WA) machines. Both transabdominal and transvaginal approaches were used. In most cases, color flow Doppler imaging was also employed. Sonographic criteria for the diagnosis of placenta accreta included placenta previa and the presence of at least one of the following findings: 1) obliteration of the normal hypoechoic or vascular subplacental zone; 2) extensive intraplacental or subplacental lacunae (dilated venous spaces); 3) tortuous vessels or lacunae in the myometrium; or 4) disruption or thinning of the uterine serosa-bladder interface.

Five patients with the sonographic diagnosis of placenta accreta underwent prophylactic pelvic artery balloon catheterization. This procedure was performed by the interventional radiology team in the angiography suite on the morning of the scheduled cesarean delivery. Under fluoroscopic guidance, using a bilateral contralateral common femoral artery approach, selective catheterization of the internal iliac arteries, their anterior divisions, or the uterine arteries was performed using occluding balloon catheters (Medi-tech, Inc., Natick, MA). Fluoroscopy time was recorded and used by the radiation physicist to determine estimated fetal radiation exposure.

All patients except one with refractory preterm labor (from the catheter group) were delivered by scheduled cesarean section. In the operating room, when total placenta accreta was found, the placenta was left in situ, undisturbed, and a cesarean hysterectomy was performed. In those patients who received prophylactic balloon catheters, the balloons were inflated after the infant was delivered and the cord clamped. The balloons were deflated at the end of the case, and the catheters removed after documenting adequate hemostasis. The efficacy of the occlusion was assessed during the case by the surgeons' assessment of the degree of hemostasis and by the estimated blood loss, which was calculated from the volume of blood in the suction canisters and the weighed laps.

TABLE 1. Characteristics of the Study Population

Age	Parity	No. of prior C/S	Other risk factors	MSAFP
28	3023	2	1 D&E	Normal
37	1021	1	2 D&E	Normal
30	3003	3	None	Elevated
32	1001	1	None	Elevated
37	2042	1	2 D&E	Elevated
29	211	2	1 D&E	Normal
29	1101	2	None	N/A
35	1001	0	Previous accreta	Normal
38	3104	4	Previous accreta	Normal

D&E = dilatation and evacuation; C/S = cesarean section; MSAFP = maternal serum alpha-fetoprotein; N/A = not available.

TABLE 2. Correlation of Sonographic Diagnoses and Clinical and Pathologic Outcomes

Ultrasound diagnosis	Gestational age (weeks)	Clinical diagnosis	Pathology
Complete previa, accreta ^{1,3,4}	23	Accreta	Accreta
Anterior previa, accreta ^{1,2}	34	Accreta	Percreta
Complete previa, accreta ^{1,2,4}	18	Percreta	Percreta
Complete previa, accreta ¹	15	Partial Accreta	Suggestive of accreta
Complete previa, accreta ^{1,2}	26	Accreta	Increta
Posterior marginal previa	21	Accreta	Accreta
Posterior/fundal placenta	31	Increta	Negative
Anterior placenta; dilated veins in lower uterine segment	26	Increta	Increta
Posterior previa	21	Percreta	Percreta

¹Loss of subplacental hypoechoic zone.

²Lacunar blood flow.

³Tortuous vessels in the myometrium.

⁴Disruption of serosa/bladder interface.

Surgical outcomes were defined as estimated blood loss, need for blood transfusion(s), injury to intraabdominal organs, and length of hospital stay. Surgical outcomes in patients who received the balloon catheters were compared with those managed without them. Statistical analysis was performed using the Mann-Whitney U test.

RESULTS

Demographic characteristics of the study population are shown in Table 1. Eight of nine patients had a history of at least one prior cesarean delivery. Placenta accreta was correctly diagnosed by sonographic examination in five of

TABLE 3. Surgical Procedures and Postoperative Course

Patient	Catheter	Procedure	EBL (cc)	Transfusion (units)	Complications	Hospital stay (days)
1	Yes	TAH	5,200	6 PRBC	Fever	5
2	Yes	SCH	5,500	4 PRBC	Fever	4
3	Yes	SCH	6,700	5 PRBC	None	5
4	Yes	C/S	1,100	None	None	3
5	Yes	SCH	2,700	7 PRBC 10 FFP 2 platelets	Bilateral ureteral injury Pulmonary edema DIC	14
6	No	TAH	4,000	2 PRBC	None	4
7	No	SCH	4,005	1 PRBC	None	5
8	No	SCH, LSO	5,605	7 PRBC	Bleeding requiring postop pelvic artery emboliza- tion	6
9	No	TAH	5,000	6 PRBC	Cystotomy	5

SCH = supracervical hysterectomy; TAH = total abdominal hysterectomy; LSO = left salpingoophorectomy; C/S = cesarean section; PRBC = packed red blood cells; FFP = fresh frozen plasma; EBL = estimated blood loss; DIC = disseminated intravascular coagulopathy.

nine patients, yielding a sensitivity of 56%. For the five patients undergoing balloon catheterizations, the catheters were placed in the internal iliac arteries ($n = 7$), its anterior division ($n = 1$), or the uterine arteries ($n = 2$). With one exception (eight French, 20 mm in the internal iliac), five French, 8.5 mm occluding balloon catheters were employed. The estimated fetal radiation exposure ranged from 4 to 20 rads, median = 6.1 rads. No patient experienced a direct complication as a result of the pelvic artery balloon occlusions. At the time of surgery, three patients were found to have a total accreta and one had a percreta and all four required cesarean hysterectomy. One patient had a partial accreta and required only a cesarean section. Correlation of the sonographic diagnoses and clinical and pathologic outcomes is shown in Table 2.

Details of the surgery and postoperative course for each case (listed chronologically by group) are shown in Table 3. The balloon occlusions were believed to be of benefit in only one of these patients (#5). All patients undergoing hysterectomy required transfusion of red cells due to postpartum hemorrhage, whether or not balloons were used. Comparison of the mean estimated blood loss, transfusion requirement, and length of hospitalization in patients undergoing hysterectomy managed with and without pelvic artery balloon occlusion catheters revealed no significant differences (Table 4).

Injury to the urinary tract occurred in two patients, one from the catheter and one from the noncatheter group. One patient had an unintended cystotomy which was identified and repaired at the time of hysterectomy. The other patient developed acute renal failure several hours after surgery. Bilateral ureteral obstruction was diagnosed with cystoscopy and bilateral nephrostomy tubes were placed. The patient had an exploratory laparotomy with bilateral ureteroneocystotomies performed 4 days after the hysterectomy.

TABLE 4. Comparison of Blood Loss, Transfusion Requirement, and Length of Hospital Stay in Patients Managed With and Without Pelvic Artery Catheters

	Catheters used		
	Yes	No	
Estimated blood loss (cc)	5,025	4,653	NS
Units of packed red cells transfused	5.5	4	NS
Hospital stay (days)	7	5	NS

Data are presented as mean.

NS = not significant; Mann-Whitney U-test.

All neonates survived. The mean gestational age at delivery was 36.8 weeks (range 32–39), with only one infant delivering prior to 36 weeks gestation. The mean birthweight was 3,027 gm (range 2,200–3,785 gm).

DISCUSSION

As the number of cesarean births has risen dramatically from a rate of 5.5% in 1970 to 22.8% in 1993 [8], so too has the number of patients presenting for obstetric care with a previous uterine incision. Having a uterine scar places a woman at increased risk of complications, such as uterine rupture, placenta previa, and placenta accreta in subsequent pregnancies. In our study, eight of nine (89%) women with placenta accreta had a history of at least one prior cesarean birth, underscoring the importance of this risk factor in identifying patients at increased risk for abnormal placentation.

Until recently, the diagnosis of placenta accreta usually occurred during the third stage of labor. Attempts at manually removing an abnormally adherent placenta are generally unsuccessful and accompanied by uncontrolled postpartum hemorrhage. Antenatal diagnosis of placenta

accreta has been accomplished using both gray-scale [6,7,9] and color Doppler sonography [10,11]. This enables preoperative planning for probable cesarean hysterectomy.

Angiographic arterial embolization has been successfully employed in a variety of obstetric conditions associated with pelvic hemorrhage. Prophylactic pelvic artery catheterization in patients at high risk of intrapartum and postpartum hemorrhage was initially described by Alvarez et al. [12]. In that series, seven patients required selective embolization for obstetric hemorrhage. Those patients who received prophylactic catheters had a significant reduction in mean blood loss and a decreased transfusion requirement and hospital stay compared with patients who received emergent catheter placement. There are also two case reports [13,14] which describe the prophylactic placement of balloon occlusion catheters in patients with sonographically diagnosed placenta percreta. These case reports favored the use of balloon catheters, reporting estimated blood losses between 1,500 and 2,000 ml and no procedure-related complications. In our preliminary experience, the use of prophylactic balloon catheters in patients with placenta accreta was not beneficial in decreasing blood loss or transfusion requirements. This lack of success may reflect the small number of patients and/or our inability to preoperatively select the optimal placement site of the balloons. Additionally, the rich collateral network of vessels in the pelvis may interfere with the efficacy of selective arterial occlusion. Balloon occlusion catheters were chosen rather than embolization, as the latter technique cannot be performed as expediently and has a high rate of procedure-related complications [15]. The main risk of our balloon technique is fetal exposure to radiation. Calculated fetal exposures in this series were judged to be safe by our radiation physicist, based on available literature [16].

Antenatal sonographic diagnosis of placenta accreta is critical for preoperative planning. The majority of patients with placenta accreta will require cesarean hysterectomy and blood transfusion. The role of prophylactic pelvic artery balloon catheters in decreasing blood loss and transfusion requirements and facilitating surgery requires further inves-

tigation to determine whether these potential benefits outweigh the risks of fetal radiation exposure.

REFERENCES

1. Berg CJ, Atrash HK, Koonin LM, Tucher M. Pregnancy-related mortality in the United States, 1987-1990. *Obstet Gynecol* 1996;88:161-167.
2. Kaunitz AM, Hughes JM, Grimes DA, Smith JC, Rochat RW, Kafrisen ME. Causes of maternal mortality in the United States. *Obstet Gynecol* 1985;65:605-612.
3. Stanco LM, Schrimmer DB, Paul RH, Mishell DR. Emergency peripartum hysterectomy and associated risk factors. *Am J Obstet Gynecol* 1993;168:879-883.
4. Clark SL, Koonings PP, Phelan JP. Placenta previa/accreta and prior cesarean section. *Obstet Gynecol* 1985;66:89-92.
5. Chattopadhyay SK, Kharif H, Sherbeeni MM. Placenta previa and accreta after previous cesarean section. *Eur J Obstet Gynecol Reprod Biol* 1993;52:151-156.
6. Finberg HJ, Williams JW. Placenta accreta: prospective sonographic diagnosis in patients with placenta previa and prior cesarean section. *J Ultrasound Med* 1992;11:333-343.
7. Guy GP, Peisner DB, Timor-Tritsch IE. Ultrasonographic evaluation of uteroplacental blood flow patterns of abnormally located and adherent placentas. *Am J Obstet Gynecol* 1990;163:723-727.
8. Rates of cesarean delivery—United States, 1993. *MMWR Morb Mortal Wky Rep* 1995;44:303-307.
9. Hoffman-Tretin JC, Koenigsberg M, Rabin A, Anyaegbunam A. Placenta accreta—additional sonographic observations. *J Ultrasound Med* 1992;11:29-34.
10. Rosemond RL, Kepple DM. Transvaginal color doppler sonography in the prenatal diagnosis of placenta accreta. *Obstet Gynecol* 1992;80:508-510.
11. Chou MM, Ho ESC. Prenatal diagnosis of placenta previa accreta with power amplitude ultrasonic angiography. *Am J Obstet Gynecol* 1997;177:1523-1525.
12. Alvarez M, Lockwood CJ, Ghidini A, Dottino P, Mitty HA, Berkowitz RL. Prophylactic and emergent arterial catheterization for selective embolization in obstetric hemorrhage. *Am J Perinatol* 1992;9:441-444.
13. Paull JD, Williams SL, Davison G, Devine T, Holt M. Balloon occlusion of the abdominal aorta during cesarean hysterectomy for placenta percreta. *Anaesth Intensive Care* 1995;23:731-734.
14. Dubois J, Garel L, Grignon A, Lemay M, Leduc L. Placenta percreta: balloon occlusion and embolization of the internal iliac arteries to reduce intraoperative blood losses. *Am J Obstet Gynecol* 1997;176:723-726.
15. Hemingway AP, Allison DJ. Complications of embolization: analysis of 410 procedures. *Radiology* 1988;166:669-672.
16. Wagner LK, Lester RG, Saldana LR, editors. Exposure of the pregnant patient to diagnostic radiations. Philadelphia: JB Lippincott; 1985.