CEOG Clinical and Experimental Obstetrics & Gynecology

Pelvic arterial embolization for postpartum hemorrhage: long term results of a single center experience in 29,091 deliveries

D. Rossetti[1], S.G. Vitale[2], F.A. Gulino[3], A. Biondi[3], P. Cignini[4], A.M.C. Rapisarda[2], S. Privitera[5], L. Frigerio[1]

[1] Department of Obstetrics and Gynecology, "Papa Giovanni XXIII" Hospital, Bergamo
[2] Department of Medical Surgical Specialties, Gynaecology and Obstetrics Section, University of Catania, Catania
[3] Department of Surgery, University of Catania, Catania
[4] Department of Gynecologic Ultrasound Imaging, ALTAMEDICA Fetal Maternal Medical Centre, Rome
[5] Biomedical Sciences and Biotechnology Department, University of Catania, Catania (Italy)

Summary

Purpose of investigation: To evaluate the rate of all postpartum hemorrhages (PPHs) treated with uterine embolization in a third level delivery center. *Materials and Methods:* Since January 2008 to March 2014, 29,091 deliveries were registered in the present hospital in Bergamo, Italy. Among these deliveries, 2,002 cases (6.8%) of PPHs occurred. Seventy-three patients with severe obstetric hemorrhage underwent uterine artery embolization (UAE) (47 cases, 1.61/1,000 deliveries) or hysterectomy (26 cases, 0.89/1,000 deliveries). All identified cases were followed up by telephone on January 2015 in order to evaluate long term results. *Results:* Embolization was performed successfully in 45 patients (95.7%). Two women underwent total abdominal hysterectomy: one patient for uterine atony and one for adherent placenta. In the follow up all the women interviewed reported the return of their menstrual cycle and 95.2% of women reported regular cycles. *Conclusions:* Embolization showed a success rate of 95.7%. For this reason, in the authors' opinion, it is the best choice as second line treatment of PPH, when patient is hemodynamically stable.

Key words: Post-partum hemorrhage; Hysterectomy; Uterine artery embolization; Uterine atony.

Introduction

Postpartum hemorrhage (PPH) is defined as more than 500 cc blood loss after vaginal and more than 1000 cc blood loss after cesarean delivery [1]; it is a common and severe complication of delivery.

PPH causes hypovolemic shock, disseminated intravascular coagulation, renal and liver failure, and acute respiratory distress syndrome [1, 2]. Its main causes are: uterine atony, genital tract lacerations, retained placenta, uterine rupture or inversion, and coagulopathies. [3].

Effective primary management requires the use of uterotonic agents, suturing lacerations, fundal massage, uterine cavity revision, bimanual uterine compression, and uterine tamponade. In case of failure of these procedures, ligation of hypogastric vessels, compressive suture (as B-Lynch uterine compression) or hysterectomy are generally performed [3].

In selected cases, embolization is an alternative to hysterectomy. Uterus and fertility preservation represent the main advantages of this procedure [4]. Uterine embolization became a common procedure in the last decades; however, few large series have been published on its middle- to long-term outcomes.

In this manuscript, the authors present the results of all PPHs treated with uterine embolization in a third level delivery center in Bergamo, Italy.

Materials and Methods

This is a retrospective analysis of patients who delivered and underwent uterine artery embolization (UAE) due to PPH in the period between 2008 and 2014 at the "Papa Giovanni XXIII" Hospital, in Bergamo, a third level delivery center in Italy. During the period from January 2008 to March 2014, 29,091 deliveries were registered in the hospital. Among these deliveries, 2,002 cases (6.8%) of postpartum hemorrhage (> 500cc) occurred (Table 1).

According to the hospital protocol and national guidelines, 73 patients with severe obstetric hemorrhage, resistant to medical treatment and manual or instrumental uterine revision (in case of vaginal birth), underwent (47 cases, 1.61/1,000 deliveries) or hysterectomy (26 cases, 0.89/1,000 deliveries). Women received UAE only if they were hemodynamically stable [5-8]. In other cases progressive vessel ligation and compressive suture were performed; when these attempts were not successful, hysterectomy

Revised manuscript accepted for publication May 21, 2015

Table 1. — *Characteristics of patients, deliveries, and causes of hemorrhage.*

	No. (%)
Mean age (years)	30 (range: 22 – 39)
Multiple pregnancies	2 (4%)
Preterm birth	8 (17%)
Mode of delivery	
Vaginal	24 (51%)
Cesarean section	23 (49)
Elective cesarean section	11 (23%)
Urgent cesarean section	12 (25%)
Epidural anesthesia	8 (17%)
Episiotomy	7 (14%)
Perineal laceration grade I-II	8 (17%)
Causes of hemorrhage	
Uterine atony	28 (60%)
Retention of placenta	9 (19%)
Adherent placenta	5 (10%)
Incomplete placental expulsion	4 (8%)
Amniotic acute infection	1 (2%)
Intrauterine fetal death	1 (2%)

was the chosen treatment. This study reports only cases of uterine embolization. All uterine embolizations were carried out in the operative room of the Radiology Department of the "Papa Giovanni XXIII" Hospital of Bergamo. For all cases the following data were retrieved by evaluation of clinical records: maternal age, gestational age at birth, parity, mode of delivery, epidural analgesia, episiotomy, birth weight, hemoglobin value, number of packed red blood cell or platelet transfusions, failures of embolization, and complications. The cause of hemorrhage was evaluated: uterine atony, abruptio placentae, placenta praevia, cervix injury, placental accreta, and percreta, myoma (diagnoses accepted by obstetricians and sometimes confirmed by a histological exam).

All identified cases were followed up by telephone in January 2015 in order to evaluate long term results. The patients were asked about any complication after embolization procedure, return of normal menstrual cycle, and presence of pelvic pain. Furthermore they were asked: 'Did you become pregnant after the procedure?', 'If yes, when and how did you give birth?', 'If not, do you intend to have more children?' Follow up data were obtained from 42 subjects. In five cases the patients were lost at follow up.

Embolization procedure

UAE for the treatment of PPH was performed only after all usual obstetric maneuvers for the treatment of PPH and in hemodynamically stable patients. The patients were transported to the Radiology Department (ten minutes from the delivery room), accompanied by a gynecologist and an anesthesiologist. An interventional radiologist performed each procedure. The femoral artery was cannulated and an angiogram provided a roadmap for the catheter as it was maneuvered into uterine arteries. The embolic agent was released into both the right and left uterine arteries by repositioning the same catheter that was originally inserted. At the end of the procedure, the catheter was removed and pressure was applied to stop any bleeding. The area of the skin where the catheter was inserted was then covered with a dressing.

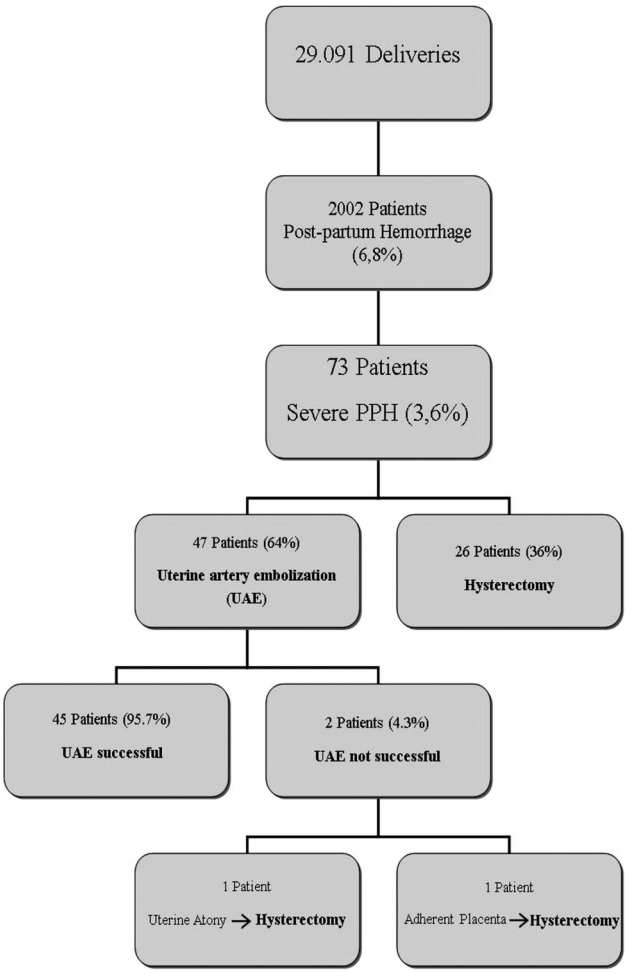

Figure 1. — Algorithm of deliveries and PPH.

Results

The characteristics of the 47 cases are shown in Table 1. Forty-four women underwent the procedure following primary PPH. In three cases, bleeding occurred at respectively, 36 hours, 60 hours, and 13 days after delivery. One patient had both intrauterine fetal death and amniotic acute infection as cause of PPH.

The mean value of hemoglobin, measured before the procedure was 8.9 g/dl (range 4.5 to 14.4). All patients underwent blood transfusion before the procedure: mean four bags of packed red blood cells (range one to 14) and two fresh frozen plasma (range one to ten).

Procedures before embolization

The procedures and/or drugs to resolve the hemorrhage before embolization were: syntocinon (10−50 IU) in 23 cases (48.9%), nalador (1−3 fl) in 33 cases (70.2%), cytotec (800 mg) in two cases (4.2%), calcium gluconate (2 fl) in six cases (12.7%), and tranex (2 fl) in one case (2.1%).

Uterine tamponade was performed in 26 cases (55.3%),

Table 2. — *Long term follow-up.*

	Number (%)
Pelvic pain	1/42 (2%)
Lower limb circulatory disorder	1/42 (2%)
Return of the menstrual cycle	42/42 (100%)
Regular menstrual cycles	40/42 (95%)
Plan to become pregnant again	21/42 (50%)
Pregnancy after embolization	3/42 (7%)

revision of the uterine cavity in 21 (44.6%) cases, and manual placental removal in three cases (6.4%).

Embolization results

The mean time between delivery and embolization was 605 minutes in cases with primary hemorrhage (range 60 to 6.030 minutes). During the embolization procedure no complication was observed. Embolization was performed successfully in 45 patients (95.7%) (Figure 1). Two women, respectively, two and three hours after the procedure, underwent to total abdominal hysterectomy: one patient (of 28) with uterine atony and one (of five) with adherent placenta. Six patients (12.7%) were admitted to the intensive therapy unit due to blood loss and risk clinical conditions that required intensive monitoring. The average hospital stay was 11 days (range 3 to 90).

Long term follow up

At follow up one patient reported to suffer from pelvic pain after embolization and a woman reported lower limb circulatory disorders. All the women interviewed (42/42, 100%) reported the return of their menstrual cycle, in a mean time range of 14 weeks (range 5– 24) and 95.2% of women (40/42) reported regular cycles (Table 2). Twenty-one women (50%) reported a plan to become pregnant again. Of these, only three patients had already planned the pregnancy, the remaining 18 said they wanted more children, but had not yet planned the pregnancy. Of the three women who sought a subsequent pregnancy, a patient had a miscarriage at seven weeks gestation. The second patient completed the pregnancy. Neonatal outcome was good, with the birth of a child of appropriate weight for gestational age and in good health. The delivery of this patient was completed through the vagina with recurrent PPH. She underwent embolization procedure again and then, following the failure of this, a hysterectomy was performed. The third patient had a normal pregnancy with planned cesarean section for breech presentation: at cesarean section a hysterectomy was performed for placenta accreta.

Long term results

All treated women reported return of menstrual cycle (42/42; 100%) after the procedure and almost all in a regular way (40/42; 95.2%). This rate is consistent or higher than previously reported [8, 9]. Out of the three women who had a subsequent pregnancy, only two had a term delivery: in one case PPH also occurred in the second birth, requiring embolization and then hysterectomy; in the other case, the cause of bleeding was a placenta accreta with subsequent hysterectomy.

Discussion

The aim of this study was to evaluate the effectiveness of uterine embolization in the treatment of uterine PPH and the middle- to long-term results of it.

In order to identify a homogeneous group of patients, the authors included only women who delivered at their hospital, not considering patients treated in their center, but delivered in other hospitals. The management of PPH could differ in different centers. In the authors' delivery room, in accordance with Italian and international guidelines (ACOG, RCOG), uterine embolization was considered only in case of failure of first line medical treatment and procedures, and after ensuring the patient's hemodynamic stability.

The rate of PPH observed in this study is similar to the rate reported in the literature [10]. Likewise the rate of postpartum hysterectomy observed in the authors' centre in the considered period is largely similar to the rates reported in the same period in other Italian hospitals [5]. In the present data, 60% of PPH were caused by uterine atony. This figure is consistent with the data reported in literature, showing percentages ranging from 45% to 78% [4, 6, 7, 10]. The success rate of embolization was 95.7%. Studies conducted in different countries have reported success rates ranging between 73% and 100% [5, 10-15].

In the present series, embolization failure was observed in one case of uterine atony and in one case of adherent placenta. In a study conducted between 1996 and 2001 by Tourné *et al.* [7], among 12 embolization procedures, the only hysterectomy was performed in a case of retained placenta.

In the present study, no patients required a second embolization. In the literature a second embolization has been reported ranging from 8% to 15% of cases [5, 11, 13, 14]. The major complications of embolization procedure reported in the literature are: dissection, allergy to contrast, hematoma at the injection site of the catheter and pain [11,13,16]. In this study none of these complications occurred.

Conclusions

In conclusion, in this study embolization showed a success rate of 95.7%. For this reason, in the authors' opinion, it is the best choice as second line treatment of PPH, when patient is hemodynamically stable.

The results at distance of the present cases showed that in all cases, regular menstrual cycles were restored: all

women have maintained their reproductive potential and in two cases the patients obtained a second birth. This underlines the role of embolization procedure in preserving fertility.

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Address reprint requests to:
S.G. VITALE, M.D.
Department of Medical Surgical Specialties,
Gynaecology and Obstetrics Section,
University of Catania
Via Santa Sofia 78, 95123 Catania (Italy)
e-mail: vitalesalvatore@hotmail.com