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Uterine artery embolisation for obstetric hemorrhages treatment

Embolizacja tętnic macicznych w leczeniu krwotoków poporodowych z narządu rodneho

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Key words

postpartum haemorrhage, embolisation

Słowa kluczowe

krwawienia poporodowe, embolizacja

Summary

Introduction. The major causes of death in women of reproductive age are pregnancy and perinatal complications. According to the WHO data, postpartum haemorrhage (PPH) occurs in about 10.5% of deliveries worldwide and is the leading single cause of mortality amongs young women (estimated at about 25% of deaths). PPH is diagnosed as blood loss > 500 ml during vaginal delivery. Haemorrhages can be effectively treated avoiding surgical interventions by uterine artery embolisation (UAE).

Aim. Assessment of efficacy and outcomes of percutaneous uterine artery embolisation for the treatment of postpartum haemorrhage and assessment the validity of prophylactic catheter balloons arteries leaving in the internal iliac artery.

Material and methods. In the years 2011-2014, 12 uterine artery embolisation procedures were carried out in the Department of Interventional Radiology and Neuroradiology MU Lublin. The embolisation procedures were performed using gelatin foam or Embozene calibrated particles. The technical success was lack of contrast blood inflow into the uterine arteries.

Results. In 5 cases embolisation were performed using standard catheters and gelatin foam; in 7 cases microcatheters and spherical, calibrated Embozene particles, 500 and 700 um in diameter, had to be used. In the 11 patients, the embolisation procedures effectively stopped bleedings. In one patient, hysterectomy was performed several hours after embolisation due to further bleeding. Clinical efficacy was found to be 91%.

Conclusions. The procedure of percutaneous uterine artery embolisation seems to be an effective and safe method for the treatment of postpartum haemorrhage. The key to success is cooperation of gynaecologists and interventional radiologists and developed fast-track referral of patients. In some cases prophylactic artery catheterization balloon leaving in the internal iliac artery is also recommended.

Streszczenie

Wstęp. Krwotok poporodowy (ang. *Postpartum Haemorrhage* – PPH) występuje w około 10,5% porodów na świecie i stanowi najważniejszą pojedynczą przyczynę śmiertelności młodych kobiet (powoduje około 25% zgonów). PPH jest określany jako utrata krwi > 500 ml w czasie porodu drogami natury. Krwawienia i krwotoki z narządu rodneho można skutecznie leczyć poprzez embolizację tętnic macicznych (ang. *Uterine Artery Embolization* – UAE), która może stanowić alternatywę dla zabiegu chirurgicznego.

Cel pracy. Celem pracy jest ocena skuteczności i wyników przezskórnej embolizacji tętnic macicznych w leczeniu krwotoków poporodowych oraz ocena zasadności stosowania profilaktycznego cewnikowania tętnic z pozostawieniem balonów w tętnicach biodrowych wewnętrznych.

Materiał i metody. W latach 2010-2014 w Zakładzie Radiologii Zabiegowej i Neuroradiologii UM w Lublinie wykonano 12 zabiegów embolizacji tętnic macicznych w przebiegu krwotoku poporodowego. Materiałem embolizacyjnym była gąbka żelatynowa lub kalibrowane cząstki Embozene. Za sukces techniczny uznawano brak napływu krwi cieniującej do tętnic macicznych.

Wyniki. W pięciu przypadkach wykonano embolizację przy użyciu żelu ze spongostanu, w 7 niezbędne było użycie mikrocewnika i cząstek Embozene o średnicy 500 i 700 um.

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U 11 pacjentek zabieg embolizacji skutecznie zatamował krwawienie. Jedna chora w kilka godzin po zabiegu embolizacji ze względu na dalsze krwawienie została poddana histerektomii. Powodzenie kliniczne osiągnięto u 91% leczonych.

Wnioski. Zabieg przeskórnej embolizacji tętnic macicznych jest skuteczną i bezpieczną metodą leczenia krwotoku poporodowego. Kluczem do sukcesu jest dobra współpraca ginekologa z radiologiem zabiegowym i wypracowana szybka ścieżka kierowania chorych. W niektórych przypadkach również zalecane jest profilaktyczne cewnikowanie tętnic z pozostawieniem balonów w tętnicach biodrowych wewnętrznych.

INTRODUCTION

The major causes of death in women of reproductive age are pregnancy and perinatal complications. According to the WHO data, postpartum haemorrhage (PPH) occurs in about 10.5% of deliveries worldwide and is the leading single cause of mortality amongst young women (estimated at about 25% of deaths) (1, 2). PPH is the main cause of morbidity and mortality of parturients worldwide. In the USA, obstetric haemorrhages are responsible for 13% of peripartum deaths, with postpartum haemorrhages causing death in over 30% of cases (3, 4).

PPH is diagnosed as blood loss > 500 ml during vaginal delivery. Severe PPH is defined as blood loss exceeding 150 ml/min (at this rate, it will result in the loss of about 50% of blood volume during about 20 min) or sudden loss of 1500-2000 ml (i.e. 25-35% of blood volume) (5, 6). In full-term pregnancy, over 600 ml of blood per minute goes to the uterine-placental circulation (7). Even at a slight injury to the vascular bed, consequences might be tragic. An additional adverse factor is difficult intubation in pregnant patients, the incidence of which is 1:280 cases whereas in surgical patients – 1:2230. Some authors define haemorrhage as the haematocrit change by 10% or necessary blood transfusion. PPH requires prompt intervention, especially that the diagnosis is established when the patient is haemodynamically unstable. Early PPH occurs in 4-6% of deliveries and its most common cause is uterine atony (70% of cases) (fig. 1) (8). Bleedings can develop in vaginal deliveries and also in Caesarean sections (9). The other causes of PPH and their aetiology are presented in table 1. They can be summarised as the 4Ts (thrombin, tissue, tone, trauma). If any factor is diagnosed before the delivery, the team should be adequately prepared and the delivery well-planned. One of the possibilities of interventional radiology is the insertion of catheter balloons to the internal iliac arteries before the onset of delivery, inflating them during the delivery or in cases of bleedings, which markedly reduces the inflow of blood to the uterine-placental circulation and additionally facilitates intrauterine interventions, if necessary.

In most cases, postpartum haemorrhages can be stopped by massage of the uterus and administration of a prostaglandin E2 analogue – oxytocin resulting in muscle contraction. A relevant element is also manual and instrumental control of the uterine cavity under general anaesthesia followed by control of the genital

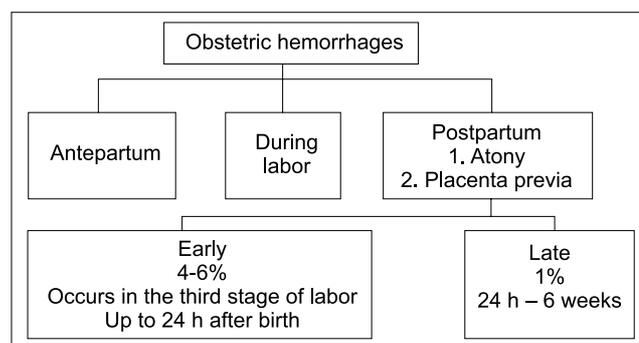


Fig. 1. According to time division of postpartum haemorrhages.

Table 1. Common causes and aetiology of PPH (17).

Cause	Aetiology	Incidence
Thrombin clotting disorders	<ul style="list-style-type: none"> - history of clotting disorders, e.g. haemophilia, von Willebrand disease, hypofibrinogenemia - acquired during pregnancy: idiopathic thrombocytopenic purpura, preeclampsia with thrombocytopenia (HELLP) - DIC due to preeclampsia, intrauterine death, premature detachment of the placenta, amniotic fluid embolism, severe infection/sepsis - coagulopathy due to dilution after massive transfusion - anticoagulants 	1%
Tone	<ul style="list-style-type: none"> - excessive uterine distension - "uterine muscle fatigue" - uterine infection - abnormalities in the uterus and placenta 	70%
Tissue	<ul style="list-style-type: none"> - left placenta/foetal membranes - abnormal placenta/additional placenta lobe - placenta accreta 	10%
Trauma	<ul style="list-style-type: none"> - trauma to the cervix/vagina/perineum - extensive trauma to the cervix - rupture of the uterus - eversion of the uterus 	20%
Additional	<ul style="list-style-type: none"> - age, prolonged delivery, BMI > 35, anaemia 	

tract and tamponade of the uterine cavity (10). If the above methods fail, interventional options should be implemented. The basic surgical treatment involves placement of compression-haemostatic suture over the uterus according to the B-Lynch technique, bilateral ligation of the uterine or internal iliac arteries with hysterectomy (11, 12).

Genital bleedings and haemorrhages can be effectively treated avoiding surgical interventions by uterine artery embolisation (UAE). UAE in gynaecology and obstetrics was first described in 1979 by Brown et al. in

a patient with postpartum haemorrhage persisting despite bilateral ligation of the internal iliac arteries (13). The UAE procedure was first described as an alternative effective method of treatment of haemorrhages in 1987. Since that time, it has been successfully used in various obstetric and gynaecologic diseases accompanied by bleedings and haemorrhages (14).

Obstetric haemorrhages are usually sudden, life-threatening events, uncontrollable by basic treatment methods, including postpartum haemorrhages, which are the main cause of maternal morbidity and mortality worldwide. When conventional methods fail, percutaneous uterine artery embolisation is an alternative to more invasive and complication-related surgical treatment (15-17).

AIM

Assessment of efficacy and outcomes of percutaneous uterine artery embolisation for the treatment of postpartum haemorrhage and assessment the validity of prophylactic catheter balloons arteries leaving in the internal iliac artery.

MATERIAL AND METHODS

In the years 2011-2014, 12 uterine artery embolisation procedures were carried out in the Department of Interventional Radiology and Neuroradiology MU in Lublin due to postpartum haemorrhages uncontrollable with classical surgery methods (fig. 2A, B). The procedure involved selective closure of uterine arteries using gelatin foam (Spongostan) or calibrated particles (Embozene). The choice of the embolisation material depended on the possibility to introduce a suitably large catheter into the vascular lumen. Catheters 5 or 4 Fr can accommodate spongostan gel whereas 2.7 Fr microcatheters only particles. The examination and procedure were performed under local anaesthesia; in 4 patients – under general anaesthesia. Angiography was carried out through a Pig-tail catheter placed in the abdominal aorta. Subsequently, anterior trunks of internal iliac arteries and uterine arteries were selectively catheterized using Roberts or Cobra catheters. For superselective catheterization microcatheters like Progreat 2.7 Fr were inserted coaxially. The technical success was lack of contrast blood inflow into the uterine arteries. The vascular access was secured with a vascular occluder or manual compression.

RESULTS

The embolisation procedures were performed in 12 patients. In 5 of them, standard catheters and gelatin foam were used; in 7 cases Progreat microcatheters and spherical, calibrated Embozene particles, 500 and 700 µm in diameter, had to be used. In one case, microcoils were additionally applied to close the vessel showing the features of active bleeding in the form of massive extravasation of the contrast medium.

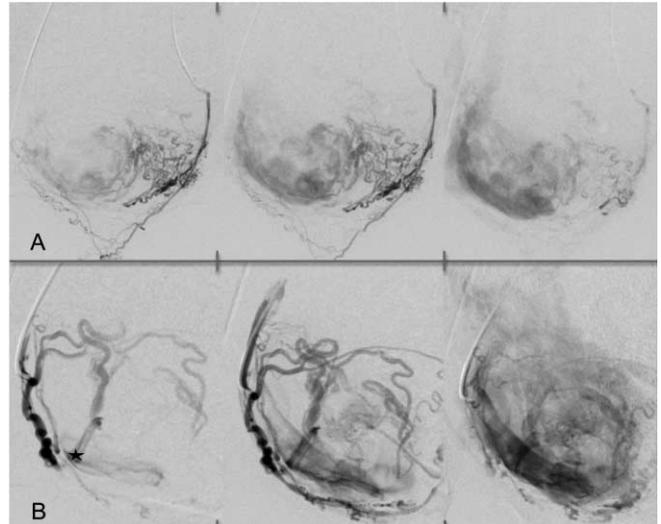


Fig. 2. Angiography after cesarian section in patient with placenta percreta showing active bleeding. A – Selective angiography of the left uterine artery. From the left to the right subsequent images from early arterial phase to the venous phase. B – Selective angiography of the right uterine artery. From the left to the right subsequent images from early arterial phase to the venous phase. Fistula into the bladder is visible (*).

In 2 cases, embolisation was carried out from the anterior trunk of the iliac artery below the gluteal artery ostium. The initial angiography showed active extravasation of contrast medium in 4 patients; after selective catheterization, the bleeding site was visualized in another 2 patients. In 11 patients, the effect was satisfactory, i.e. lack of contrast medium inflow to the uterine arteries. In one patient, unilateral embolisation was performed; the opposite uterine artery was dissected during selective catheterisation, which closed the inflow and access. In one patient, hysterectomy was performed several hours after embolisation due to further bleeding. In the remaining 11 patients, the embolisation procedures effectively stopped bleedings.

DISCUSSION

A growing number of obstetricians and gynaecologists believe that intrauterine procedures to stop bleedings are not the last chance methods after using all other options, including resective surgery, but the procedures successfully applied before potential surgery in patients, in whom pharmacological therapy or protective management failed (tab. 2). In the survey of 2002, descriptions of cases involving totally 100 patients were analysed; 97% underwent successful uterine artery embolisation due to obstetric haemorrhages (19). In the Scottish Confidential Audit of Severe Maternal Morbidity, 15 UAEs were described to control extensive PPH; and in this way hysterectomy was avoided in 10 (71%) women (20). Some authors advocate that earlier insertion of balloon catheters or classical catheters for embolisation into the anterior trunks of internal iliac arteries is a preventive measure enabling potential immediate action.

Table 2. Algorithm of management during postpartum haemorrhage (18).

Ask for help (HELP)
Assess vital parameters (pressure, pulse, saturation) (ASSESS)
Establish aetiology, prepare blood, select drugs (AETIOLOGY)
Massage of the uterus (MASSAGE)
Oxytocin/prostaglandins (OXYTOCIN)
Transport to the operating theatre – exclusion of the residues and injuries left (SHIFT)
Tamponade of the uterine cavity (TAMPONADE)
Use of compression sutures – B-Lynch (APPLY)
Systemic devascularisation of the pelvic – uterus/ovaries... (SYSTEMIC)
Radiological intervention – UAE (INTERVENTION)
Total/subtotal hysterectomy (SUBTOTAL)

Dubois et al. were the first to describe preoperative placement of occlusive balloons in the internal iliac arteries in two patients (21); Knuttinen et al. reported the survey of literature involving 38 cases successfully treated using preoperative balloon inflation in patients with placenta accreta, increta and percreta (22).

According to Alvarez et al., in cases at high risk of haemorrhage, protective balloons should be inserted

as they effectively reduce the blood loss, the percentage of indications for transfusions as well as morbidity (23). A high number of patients referred for embolisation procedures declare that they want to have more children; therefore, it is essential to determine what kind of embolisation material should be used and whether the procedure is likely to preserve reproductive potential in future. Ornan et al. reported that all patients who wanted to conceive after embolisation procedures were successful. In all the cases, the embolisation material was the spongostan gel (24).

Until significant statistical data are available, UAEs should be considered for postpartum haemorrhages; moreover, in some cases, prophylactic artery catheterization with the intent to perform embolisation should be taken into account.

CONCLUSIONS

Percutaneous uterine artery embolisation seems to be an effective and safe method for the treatment of postpartum haemorrhage. The key to success is cooperation of gynaecologists and interventional radiologists and developed fast-track referral of patients. In some cases prophylactic artery catheterization balloon leaving in the internal iliac artery is also recommended.

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