
ORIGINAL ARTICLE

Use of Uterine Artery Embolisation for Pregnancy-related Complications: a Single-Institution Experience

MC Lam, SS Lo

Department of Radiology and Organ Imaging, United Christian Hospital, Kwun Tong, Hong Kong

ABSTRACT

Objective: To evaluate the indications, efficacy, and complications of uterine artery embolisation (UAE) in different pregnancy-related conditions.

Methods: All patients who underwent UAE for pregnancy-related conditions from January 2008 to December 2013 in a regional hospital in Hong Kong were retrospectively reviewed. Indications for UAE, details of UAE procedure, success rate, and complication rate were analysed. Any reported pregnancy following UAE was also noted.

Results: A total of 24 patients underwent 25 UAE procedures. In nine patients, 10 UAE procedures were performed for scar pregnancy and its related complications. In 15 patients, UAE was performed for postpartum haemorrhage. Angiographic success rate was 100% in both groups. The clinical success rate was 80% in the postpartum haemorrhage group. The overall complication rate was 16%. There were three (12.5%) documented subsequent pregnancies.

Conclusion: Scar pregnancy and postpartum haemorrhage were the most common indications for UAE in pregnancy. UAE is safe and effective in managing these conditions.

Key Words: Embolization, therapeutic; Postpartum hemorrhage; Pregnancy complications; Pregnancy, ectopic

中文摘要

子宮動脈栓塞術治療妊娠相關合併症：單一機構的經驗

林茂珠、盧承迅

目的：評估子宮動脈栓塞術（UAE）於不同妊娠狀態下的適應症、療效和併發症。

方法：回顧研究2008年1月至2013年12月期間於香港一所分區醫院接受UAE治療與妊娠相關疾病的所有患者。分析UAE的適應症、UAE流程細節、成功率和併發症發生率，同時分析了UAE後的妊娠報告。

結果：總計24名患者接受了25次UAE。9名患者共接受10次UAE治療癥痕妊娠及相關併發症；15名患者因產後出血而接受了UAE。兩個組別的血管造影成功率為100%。產後出血組別的臨床治療成功率為80%。UAE併發症總體發生率為16%。共有3例（12.5%）術後有成功妊娠史。

結論：癥痕妊娠和產後出血是UAE治療妊娠合併症中最常見的適應症，UAE是安全有效的治療方法。

Correspondence: Dr Mau-chu Lam, Department of Radiology and Organ Imaging, United Christian Hospital, Kwun Tong, Hong Kong.

Tel: (852) 3949 4130; Email: karrylam1121@hotmail.com

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INTRODUCTION

Selective transcatheter arterial embolisation for postpartum haemorrhage (PPH) was first described in 1979 by Heaston et al.¹ In the past two decades, there have been published studies about the effectiveness and safety of uterine artery embolisation (UAE) in various pregnancy-related conditions.²⁻⁵ Local retrospective case series are also available and mainly focus on the use of UAE in PPH.^{6,7}

The purpose of this retrospective study was to analyse and report the indications and clinical outcomes including efficacy and complications of UAE in different pregnancy-related conditions in a regional hospital in Hong Kong.

METHODS

Study Design and Patient Selection

This retrospective study was carried out at a regional hospital in Hong Kong. Data for all patients who underwent UAE for obstetric reasons from January 2008 to December 2013 were retrieved from the Radiology Information System. Electronic patient records and angiographic findings during UAE were reviewed and analysed. This study was approved by our Ethics Committee with informed consent waived due to its retrospective nature.

Techniques of Uterine Artery Embolisation

All UAE procedures were performed by fellow radiologists. Unilateral or bilateral common femoral puncture was performed with a 5-French (F) vascular sheath inserted. Internal iliac artery angiogram and subsequent uterine artery angiogram on each side was performed with angiographic catheters and hydrophilic guidewire. Superselective catheterisation of the uterine arteries was performed with or without a coaxial microcatheter system. Embolic agent was injected until stasis of flow was achieved. The choice of angiographic catheters (5-F Cobra 1 [Cordis, USA], 4-F Simmons Sidewinder 1 [Terumo, Japan], 5-F Rosch Curve 1 [Cordis, USA], 5-F Rösch inferior mesenteric [Cordis, USA], and 5-F Roberts Uterine Catheter [Cook, USA]; 2.7-F Progreat microcatheter [Terumo, Japan]), embolic agent (Gelatin sponges, micro-coils and microspheres), and arteries to be embolised depended on the angiographic findings, haemodynamic status of the patient, and experience of the operator.

Data Collection and Data Analysis

Indications for UAE were reviewed, and two principal

indications were identified: scar pregnancy and its related complications, and PPH.

Scar Pregnancy and Its Related Complications

Data including maternal age, obstetric history, risk factors for scar pregnancy, gestational age, peak β -human chorionic gonadotropin (β -hCG) before UAE, subsequent operation and blood loss, length of hospital stay, percentage of β -hCG decrease on discharge, and time for β -hCG to normalise were collected.

Postpartum Haemorrhage

Data concerning maternal age, obstetric history, gestational age, indications, mode of delivery, aetiology of PPH, blood loss before UAE, subsequent hysterectomy, intra-operative blood loss, and length of hospital stay were collected.

In both groups, UAE procedural details were noted including the embolic agent used, angiographic findings, and procedure-related complications. Any reported subsequent pregnancy was also recorded. Angiographic success rate, clinical success rate, and complication rate were calculated. Clinical success was defined as no further need for surgical intervention to achieve haemostasis. All statistical analyses were of a descriptive nature. All analyses were performed using Microsoft Excel 2011.

RESULTS

A total of 24 consecutive patients underwent 25 UAE procedures for pregnancy-related complications during the study period. Nine patients had scar pregnancy and its related complications with 10 UAE performed, including one patient with two episodes of scar pregnancy and hence, two UAE performed; 15 patients underwent UAE for PPH.

Scar Pregnancy and Its Related Complications

The mean age of patients with scar pregnancy was 36 (range, 29-42) years. Gravidity ranged from 2 to 8. Peak serum β -hCG before UAE ranged from 138 to 149,062 IU/L.

Three (30%) cases had persistent per vaginal bleeding after evacuation for scar pregnancy. All bleeding stopped after the procedure without the need for hysterectomy. Three (30%) cases had preoperative UAE performed followed by same-day surgical evacuation. The remaining four (40%) had failed medical termination of pregnancy with methotrexate

and underwent UAE: two were successfully managed with UAE alone and two underwent subsequent surgical evacuation.

No case demonstrated active contrast extravasation. Selective embolisation of bilateral uterine arteries was performed in all but one patient in whom the left uterine artery spasmed during the procedure. Gelatin sponge slurry was used in six (60%) cases, microspheres in three (30%) cases, and both agents in the remaining one (10%). Immediate angiographic success was achieved in all cases. Figure 1 shows selected angiographic images of a case of scar pregnancy.

Among the five patients who underwent post-UAE surgical evacuation, blood loss was minimal except in one case where it was 700 ml.

Post-procedure hospital stay ranged from 2 to 6 days.

The mean time for β -hCG to normalise was 37.7 (range, 18-61) days, and that for documented resumption of normal menses was 86.1 (range, 28-181) days.

Postpartum Haemorrhage

The mean age of the patients with postpartum haemorrhage was 34 (range, 23-41) years. All cases were full term at the time of labour and 12 (80%) patients had a Caesarean section. The remaining three (20%) patients delivered vaginally. All patients had primary PPH. The mean blood loss was 3096.6 ml (range, 1000-10,000 ml).

Four (27%) cases showed active contrast extravasation on selective angiogram (Figure 2). They were embolised with gelatin sponge, two at anterior divisions of the bilateral internal iliac arteries and two at the bilateral uterine arteries. Five (33%) cases had embolisation performed at anterior divisions of the bilateral internal

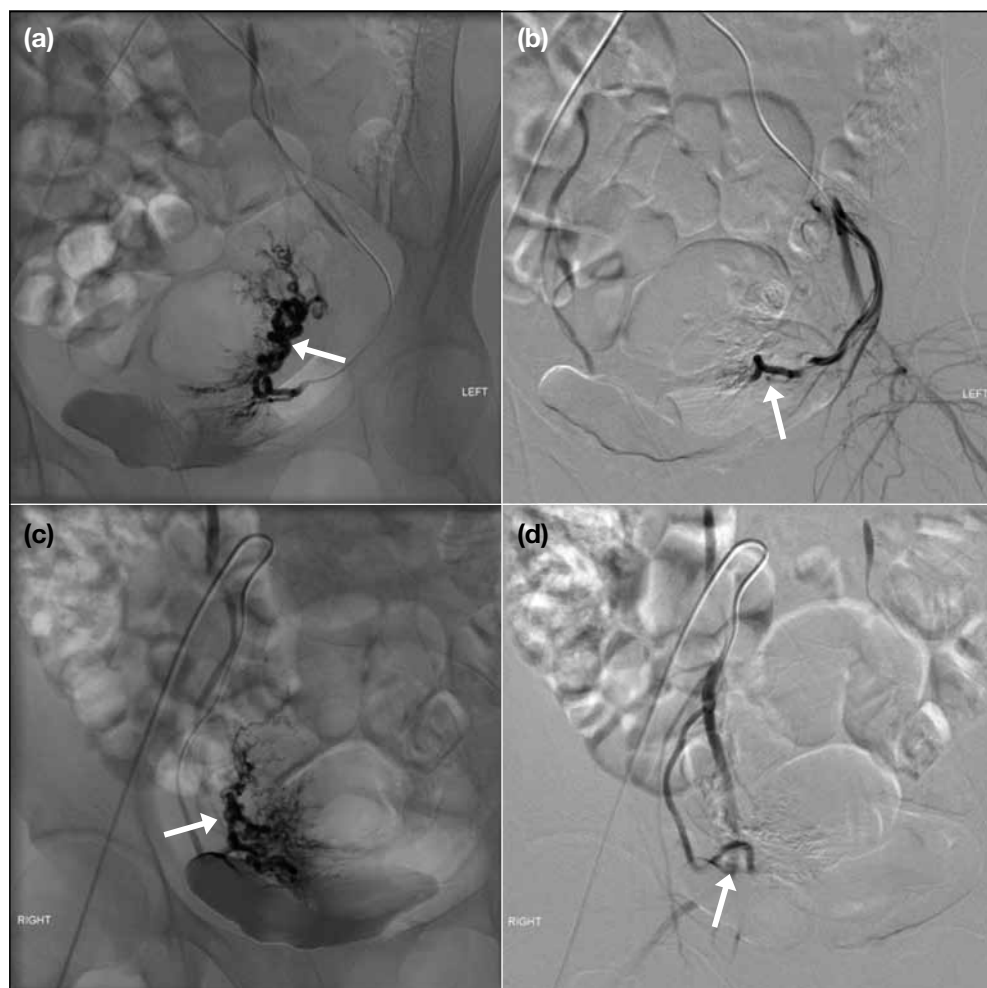


Figure 1. (a) Pre-embolisation left uterine artery angiogram showing hypertrophied left uterine artery (arrow) and its branches in a case of scar pregnancy. (b) Post-embolisation left uterine artery angiogram showing absence of flow in the ascending portion of the uterine artery and stagnant flow in the descending and transverse portions (arrow). (c) Pre-embolisation right uterine artery angiogram showing a dilated and tortuous right uterine artery (arrow) supplying the uterus. (d) Post-embolisation right uterine artery angiogram showing stagnant flow at descending and transverse portions with absent flow in the ascending portion (arrow).



Figure 2. Right internal iliac artery angiogram showing contrast extravasation from a distal branch of the right uterine artery (arrow).

iliac arteries. The remaining 10 (67%) cases underwent selective embolisation of bilateral uterine arteries. All except one case (93%) had embolisation performed with gelatin sponge slurry alone. The remaining case (7%) had embolisation performed with gelatin sponge slurry and micro-coils. Immediate angiographic success was achieved in all cases (100%). Figure 3 shows selected angiographic images of a PPH case.

The clinical success rate was 80%. Three (20%) of the 15 patients ultimately underwent surgery for haemostasis and two of them required hysterectomy. Intra-operative blood loss ranged from 1300 to 4400 ml. Post-procedure hospital stay ranged from 3 to 26 days.

Complications and Reported Future Pregnancy

Three (30%) of 10 cases in the scar pregnancy group complained of lower abdominal pain after the procedure. It resolved with analgesics and was most likely due to post-UAE syndrome. One (7%) PPH patient had contrast nephropathy after UAE and was closely

monitored in the intensive care unit. Her renal function gradually normalised with supportive treatment. The overall complication rate was 16%. There were three (13%) reported subsequent pregnancies in all UAE patients.

DISCUSSION

In our case series, the main indications for UAE were scar pregnancy and PPH, which are two well-established indications.⁸⁻¹¹ Since Heaston et al¹ reported the first case of PPH successfully managed by selective arterial embolisation in 1979, there has been expanding use of UAE in different gynaecological and obstetric conditions. Other indications have included abnormal placentation,¹² uterine fibroids,¹³ and bleeding in advanced gynaecological malignancies.¹⁴

Our case series illustrated that UAE has a high success rate in the management of scar pregnancy and PPH. We were able to achieve a 100% immediate angiographic success rate. Moreover, clinical success rate was good (80%) in the PPH group. This suggests that UAE can potentially obviate the need for hysterectomy and should be considered in patients with PPH when local and medical treatment has failed.

In our case series, five of the 15 women with PPH underwent embolisation of anterior divisions of both internal iliac arteries instead of bilateral uterine arteries. In general, selective embolisation of bilateral uterine arteries should be performed if they are accessible and patent.¹⁵ If they are inaccessible however, such as following previous uterine artery ligation or hysterectomy, embolisation of the anterior division of bilateral uterine arteries might be performed.¹⁵ In patients with active massive bleeding, selective catheterisation of the uterine arteries might not be feasible due to arterial spasm. Patients who are haemodynamically unstable can rapidly deteriorate. In such cases, the anterior division of bilateral internal iliac arteries can be embolised to achieve prompt haemostasis.¹⁶

The choice of embolic agent depends on angiographic findings and haemodynamic status of the patient. Different embolic agents have been used in UAE.¹⁷ In general, temporary embolic agents are appropriate in self-limiting conditions that may heal with time. Gelatin sponge is the most commonly used embolic agent in published data¹⁸⁻²¹ and is safe and effective. Other agents — such as polyvinyl alcohol particles,^{2,20,21}

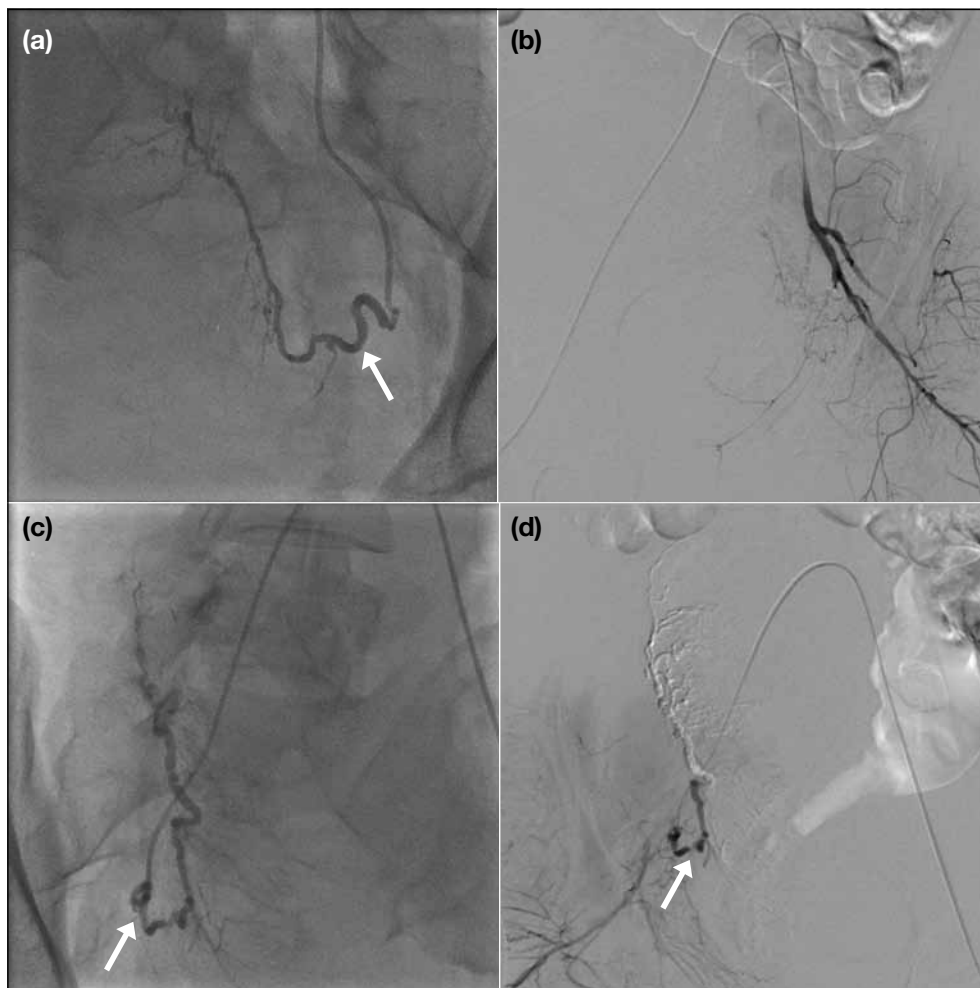


Figure 3. (a) Left uterine artery angiogram showing a mildly dilated left uterine artery in a patient with postpartum haemorrhage (arrow). (b) Post-embolisation angiogram showing absence of flow to the left uterine artery. (c) Right uterine artery angiogram showing a dilated right uterine artery (arrow). (d) Post-embolisation angiogram demonstrating stagnant flow in the descending, transverse, and ascending portions (arrow).

calibrated microspheres,²¹ glues,²⁰ and coils^{18,21} — have also been used. An earlier study by Pelage et al²² showed that small particles (i.e. microspheres <500 µm and polyvinyl alcohol particles <400 µm) were associated with more necrosis. Hence, medium-to-large-sized particles (e.g. 500-700 µm and 700-900 µm microspheres, respectively) are preferred and were used in our series. Coils are usually used in cases of arterial injury, such as pseudoaneurysm and arteriovenous fistula formation.

Over the past decades, there has been emerging evidence to support the use of UAE in abnormal placentation. Placenta accreta occurs when the chorionic villi invade the myometrium via decidua basalis defects. Placenta accreta refers to the stage of abnormal placentation with superficial uterine attachment. Placenta increta refers to placental penetration into the myometrium. Placenta percreta is the most severe form

in which the placenta penetrates through the uterine wall and invades other pelvic organs. UAE has been reported to be successful in reducing PPH both prophylactically²³ and in an emergency.^{5,24} A conservative approach has been reported in which the placenta is left in-situ. UAE serves as an adjunct that promotes resorption and spontaneous passage of the placenta over the ensuing months.^{5,23} The most commonly used embolic agent was gelatin sponge, although other agents such as calibrated microspheres and coils have also been reported.⁵

The overall complication rate for UAE is 6% to 9%.²⁵⁻²⁷ Angiography-related complications included puncture site haematoma, vascular injury, and contrast-related allergy and nephrotoxicity. There was one (4%) case of contrast nephropathy in our series. The patient had mild renal impairment (serum creatinine, 121 µmol/l) before the procedure and her serum creatinine level shot up to 572 µmol/l on day 3 but gradually normalised

with supportive treatment. Post-embolisation syndrome is commonly encountered and has been reported to occur in up to 50% of patients.^{26,28} It is characterised by abdominal pain, fever, nausea, and leukocytosis immediately after the procedure and may last for several days. There were four (16%) cases in our series who experienced post-embolisation syndrome (abdominal pain and low-grade fever) that resolved with conservative management. Rare reported complications include uterine necrosis or rupture, sepsis, abscess, and ischaemia of adjacent tissue.^{27,29}

There are studies that report successful pregnancy after UAE despite a higher rate of adverse outcomes.^{30,31} There were three (13%) cases of documented pregnancy following UAE in our series. Nonetheless the rate of subsequent pregnancy might have been underestimated, as about half of the patients were non-eligible persons from China who returned to the mainland after treatment and were lost to follow-up.

Interpretation of our findings is limited by the retrospective, case-series nature of the study as well as the small number of patients included. In addition, future pregnancy after UAE and outcomes could not be accurately measured. Half of the patients were non-eligible persons who were subsequently lost to follow-up and the rest were discharged from the outpatient clinic after documented recovery from the acute episode.

CONCLUSION

Scar pregnancy and PPH were the most common indications for UAE in pregnancy. Our case series illustrates that UAE is safe and effective in managing these conditions.

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