

Superselective embolisation of bilateral superior vesical arteries for management of haemorrhagic cystitis

CL Cho 曹澤霖
Miranda HY Lai 黎曉欣
HS So 蘇慶成
Kimmy KM Kwok 郭勁明
James CS Chan 陳志生
Venu Velayudhan

Bladder haemorrhage is common and sometimes life-threatening. Management options include bladder irrigation and supportive transfusion, intravesical instillation, endourological intervention, and surgical intervention which has poor success and high morbidity rates. Percutaneous arterial embolisation offers another minimally invasive option. We report two patients with severe haemorrhagic cystitis treated with superselective embolisation of bilateral superior vesical arteries. The technique is safe and effective for achieving immediate control of refractory bladder haemorrhage. The long-term efficacy of the procedure requires further investigation.

Introduction

Haemorrhagic cystitis is characterised by the formation of thin mucosal blood vessels together with oedema of the bladder mucosa.¹ Bleeding from telangiectatic dilation of these vessels can be massive and life-threatening.

The aetiology of haemorrhagic cystitis is diverse. This condition develops most commonly as a complication of pelvic irradiation or the use of chemotherapeutic drugs. A number of methods have been used to control bladder haemorrhage. Initial management includes hyperhydration, bladder irrigation, and transfusion of blood components, but this is usually ineffective in severe haemorrhagic cystitis. Intravesical instillation of prostaglandin, phenol, formalin, alum, silver nitrate, and epidermal growth factors² have all achieved some success. Hyperbaric oxygen therapy³ and antiviral agents are other therapeutic strategies that have been reported in the literature. Endourological treatments including transurethral electrocoagulation, laser coagulation, or argon beam coagulation are frequently performed in refractory cases but the effects are not long-lasting and multiple procedures may be necessary. Major surgical procedures such as ligation of the hypogastric arteries, urinary diversion with or without cystectomy, are the last resort and are associated with high morbidity and mortality.

The introduction of percutaneous arterial embolisation has provided a minimally invasive and less morbid option to patients suffering from severe haemorrhagic cystitis. The percutaneous endovascular procedure was first reported in 1974 by Hald and Myging.⁴ Refinement of both techniques and instruments has enabled the development of selective embolisation of the anterior division of the internal iliac artery and superselective embolisation of the vesical artery.

We report our initial experience with managing two patients who had severe haemorrhagic cystitis with superselective embolisation of bilateral superior vesical arteries.

Key words

Cystitis; Embolization, therapeutic; Hemorrhage; Urinary bladder diseases

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Case reports

Case 1

A 43-year-old man came to our attention with a history of intermittent gross haematuria for 7 years, which had recently become more severe. He had been diagnosed with polyarteritis nodosa and put on a course of cyclophosphamide 10 years earlier. He had multiple medical co-morbidities including hepatitis B-related membranoproliferative glomerulonephritis with chronic renal failure. Three laparotomies had been performed in another institution approximately 10 years earlier for tuberculous (TB) peritonitis, intestinal obstruction due to adhesions and elective repair of an abdominal aortic aneurysm, leaving multiple abdominal scars and the possibility of extensive adhesions.

A cystoscopy with electrocauterisation was performed as the best means of managing persisting haematuria refractory to bladder irrigation in a transfusion-dependent patient.

Division of Urology, Department of Surgery, United Christian Hospital, 130 Hip Wo Street, Kwun Tong, Hong Kong
CL Cho, MRCS (Ed)
MHY Lai, FRCS
HS So, FRCS (Urology) (Edin), FHKAM (Surgery)
KKM Kwok, FRCS
JCS Chan, FRCS, FHKAM (Radiology)
V Velayudhan, FRCS (Glasg), FHKAM (Surgery)

Correspondence to: Dr CL Cho
E-mail: chochaklam@yahoo.com.hk

雙側膀胱上動脈的超選擇性栓塞術治療出血性膀胱炎

膀胱出血的情況雖然很普遍，有時卻可致命。一些處理方法，如膀胱灌注及支撐性輸血、膀胱灌藥、腔內泌尿技術及外科技術的成功率低，死亡率高。經皮出血動脈栓塞術為病人提供另一種微創手術的選擇。本文報告兩名患有嚴重出血性膀胱炎的病人，接受了雙側膀胱上動脈的超選擇性栓塞治療。此技術為難治性出血性膀胱炎提供了既安全又有效的應急處理。需進一步研究此技術的長期療效。

Medical Embosphere 500-700 μm ; BioSphere Medical, Rockland, US) was injected until stasis was achieved (Fig 2).

Mild haematuria persisted so embolisation of the right superior vesical artery via the same femoral puncture site was performed a week later. Superselective catheterization of the right and then the left superior vesical artery was performed with S1 and co-axial microcatheters. The same embolisation agent was used. The bladder haemorrhage resolved immediately and the patient experienced no ischaemic pain or discomfort.

The patient remained free of haemorrhage for 2 months before re-presenting with mild haematuria which subsided spontaneously in a few days. At 3 months' post-embolisation he was admitted for a recurrent bladder haemorrhage requiring blood transfusion. A cystoscopy revealed healthy bladder mucosa except for a few bleeding points from erythematous areas over the posterior wall and in the bladder neck region. He responded well to electrocauterisation and was discharged. He has had no further episodes of haematuria in the 7 months post-embolisation.

Case 2

A 61-year-old woman was admitted in October 2007 for acute renal failure and gross haematuria. She had a history of stage IIB endometrial carcinoma of the cervix managed with a hysterectomy, bilateral pelvic lymph node dissection and bilateral salpingo-oophorectomy 5 years earlier. Adjuvant radiotherapy was given after the operation. She also gave a history of carcinoma of the descending colon managed with a Hartmann's operation 4 years ago.

Her blood tests revealed a serum creatinine of 1046 $\mu\text{mol/L}$, haemoglobin of 93 g/L, a haematocrit of 0.26, and a platelet count of $34 \times 10^9/\text{L}$. An emergency cystoscopy and retrograde pyeloureterogram showed irradiation cystitis changes to the bladder mucosa and short segments of stricture over intramural ureters bilaterally. 7-French double J catheters were inserted. Her renal function returned to normal after the procedure but her haematuria persisted despite bladder irrigation and correction of her thrombocytopenia and coagulopathy. The refractory bladder haemorrhage rendered the patient transfusion-dependent.

Superselective embolisation of bilateral vesical arteries was offered in view of her history of multiple abdominal and pelvic surgeries and irradiation. A 4-French S1 Glidecath (Simmons/Sidewinder 1, Radifocus Glidecath) and a co-axial 2.7-French Progreate (Terumo Progreate microcatheter system, Terumo, Tokyo, Japan) microcath, had to be used to manage the difficult cannulation of the superior

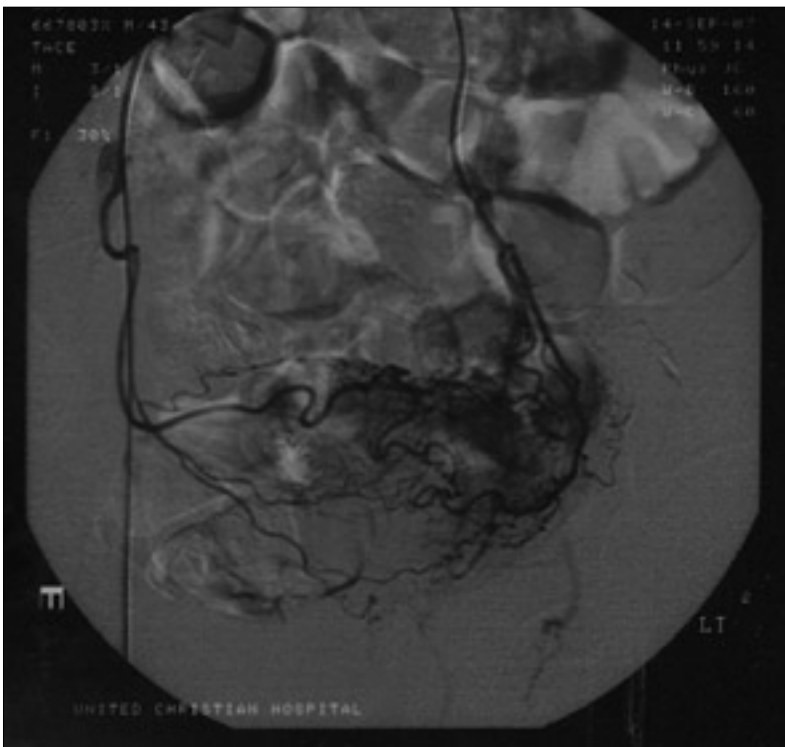


FIG 1. Pre-embolisation pelvic angiogram showing increased vascularity in the pelvic area and in the terminal regions of the vessels, and retrograde filling of the contralateral system

He responded well for 4 weeks but was admitted to our hospital in September 2007 for recurrent haematuria.

To avoid surgery, the left superior vesical artery was embolised. A retrograde catheterization of the right common femoral artery was done under local anaesthesia involving insertion of an arterial sheath. A double-curved S1 (Simmons/Sidewinder 1, Radifocus Glidecath; Terumo, Tokyo, Japan) catheter was introduced and crossed over to the left internal iliac artery. In order to delineate the anatomy of the superior vesical, obturator and internal pudendal arteries, a digital arteriogram was carried out (Fig 1). Superselective cannulation of the left superior vesical artery was achieved. Embosphere (BioSphere

vesical artery. Embosphere (500-700 μm) was used as the embolisation agent. The post-embolisation angiogram showed complete occlusion of the vesical arteries with preservation of the other major branches of the internal iliac artery. Her haematuria stopped immediately after the procedure and she developed no acute complications.

Her haematuria recurred on day 5 and bladder irrigation was restarted on day 10. A cystoscopy and clot evacuation were performed twice on day 13 and day 24. Diffuse oozing from the right lateral wall was noted while necrotic mucosa was seen over the bladder neck, and the posterior, anterior and left lateral walls of the bladder. Revision of the double J catheters was required since they were blocked by blood clots and necrotic debris.

An emergency urinary diversion with an ileal conduit was finally performed on day 34. A cystectomy was not feasible because the scarred bladder was firmly stuck in the pelvic cavity. The patient recovered without incident and the haematuria subsided. She was discharged in good general condition after the urinary diversion.

Discussion

Superselective embolisation of the vesical artery was first described in the literature in 1980 by Kobayashi et al.⁵ The technique is now an accepted therapeutic approach with proven efficacy for haemorrhagic cystitis associated with radiotherapy⁶ and tumours.⁷

Although many authors have stated that occlusion of the entire hypogastric artery or arteries is well-tolerated and without severe complications,^{4,8} unfortunate cases of bladder necrosis following embolisation of the bilateral hypogastric arteries have been reported.^{9,10}

The technique of superselective embolisation of the vesical arteries potentially avoids extensive occlusion of peripheral vessels and may decrease the incidence of side-effects, such as post-embolisation gluteal pain, claudication, genital injury, or tissue necrosis. Despite the limited number of reports in the literature, the initial experience with the superselective approach is promising. Haemorrhage-free periods of up to 12 months have been achieved.¹¹ No major complications have been observed to our knowledge. In contrast to embolisation of more proximal arteries, the superselective approach prevents the hazards of reflux of embolic material and therefore widens the spectrum of embolic materials that can be utilised. The use of adaptable microspheres of various sizes provides marked plasticity and better occlusion of vessels. We chose Embosphere ranging from 500 to 700 μm in size as the embolisation agent. This size allows penetration into the targeted capillary bed and prevents redevelopment of a collateral supply.

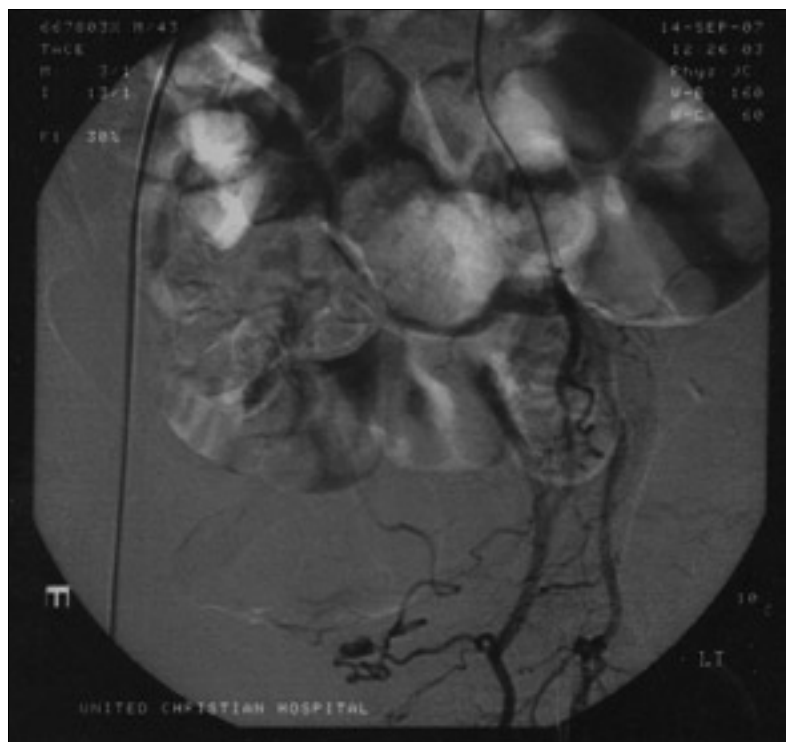


FIG 2. Post-embolisation pelvic angiogram showing evidence of obliteration of the left superior vesical artery with a marked reduction in the dilated and tortuous terminal regions of the vessels

On the other hand, the microparticles are large enough not to cross into the contralateral system via the abnormally dilated vessels.

The excellent results reported above were not reproduced in our cases. In case 1, the patient enjoyed a haemorrhage-free period for 2 months only. The embolisation procedure contributed to the control of his bladder haemorrhage as proven by the cystoscopic finding of a marked reduction in telangiectatic vessels. But the need for blood transfusions and endourological intervention due to recurrent haematuria at 3 months' post-embolisation was far from satisfactory. Longer follow-up is required before we can comment on the long-term efficacy of the procedure. A report on the success of interval embolisation as a means of controlling severe haemorrhagic cystitis is available.¹² The choice between interval embolisation, cystoscopic procedures, or major surgery to manage recurrent haematuria after initial embolisation should be an individual one. A major complication, bladder necrosis following embolisation, occurred in case 2. This patient's multiple co-morbidities may have been indicative of an undesirable outcome. Nevertheless, it is worth noting that patients suffering from severe haemorrhagic cystitis are usually debilitated, regardless of the underlying aetiology. Embolisation of bilateral superior vesical arteries is usually performed in a single session, unlike the staged

procedure performed in case 1. We do not know how this affects the risk of bladder necrosis. Superselective embolisation can theoretically reduce the formation of collateral vessels. Theoretically, the time interval between the two embolisation procedures may allow formation of collaterals and therefore decrease the incidence of bladder necrosis. But the impact on the clinical outcome is probably minimal. Another point worth noting is that the histological features of the obliterative endarteritis associated with irradiation cystitis may jeopardise the bladder blood supply and thus increase the risk of bladder necrosis.

Superselective embolisation has an immediate effect on the control of severe and life-threatening bleeding. The procedure is relatively safe and minimally invasive, and can be repeated if necessary.¹² It provides a good alternative for patients suffering from severe haemorrhagic cystitis who are poor surgical risks. The possibility of using superselective

embolisation as the definitive bladder-preserving treatment is uncertain. More information concerning its long-term efficacy is required. There is doubt that it can be used as a single modality in the management of severe haemorrhagic cystitis, but superselective embolisation has the potential to be an effective preoperative adjunct able to reduce transfusion requirements and operative risk. Use of a more selective approach should be able to lower the incidence of post-embolisation ischaemic events but the possibility of this major complication should not be overlooked.

In summary, superselective embolisation of bilateral vesical arteries is a safe and effective procedure for achieving immediate control of refractory bladder haemorrhages. It should be considered in patients with severe haemorrhagic cystitis, especially those who are poor surgical candidates.

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