Case Reports

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Selective Vesical Artery Embolization for Controlling Hematuria due to Actinic Cystitis

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This article describes the case of a 45-year-old female patient who had been treated with radiotherapy for vaginal cancer and who developed actinic cystitis with frequent episodes of severe hematuria, requiring repeated blood transfusions. The patient was treated with selective embolization of the vesical arteries. The procedure was successful, and the patient has been in follow-up for six months without other hematuria episodes, nor needing further blood transfusions or hospital admissions. A review of technical aspects regarding bladder embolization and possible complications related to this procedure is also provided.

Keywords: *Therapeutic Embolization; Cystitis; Hematuria; Endovascular Procedures; Urinary Bladder*

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INTRODUCTION

Untreatable hematuria secondary to actinic cystitis constitutes a therapeutic challenge since, in many patients, severe hematuria cannot be controlled by conservative measures such as bladder irrigation or endoscopic procedures with electrocoagulation, laser or argon hemostasis [1,2].

When hemostasis is not achieved, cystectomy may be performed, but besides being a high complexity procedure, individual features such as age and comorbidities may increase surgical risk [1–3].

Although not frequently performed and accounting for few case descriptions in the literature, selective arterial embolization may be considered as a minimally invasive option for stopping hemorrhage secondary to actinic cystitis, avoiding cystectomy [3–6].

This article reports the case of a 45-year-old female patient who has developed episodes of severe hematuria secondary to actinic cystitis and was treated with selective embolization of the vesical arteries.

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CASE PRESENTATION

A 45-year-old woman presented with recurrent hematuria episodes that became progressively more frequent and intense, being triggered even by daily basic physical activities and requiring repeated blood transfusions.

The patient reported having received 27 radiotherapy sessions and chemotherapy for treating a vaginal cancer (squamous cell carcinoma) three years previously.

After approximately 12 months presenting with hematuria at minimal physical efforts, the urologist referred the patient to a vascular surgeon to be assessed for embolization of vesical arteries, which was performed electively and under epidural anesthesia.

Vascular access was obtained under ultrasound guidance, by a retrograde puncture of the right common femoral artery, and a 5F angiographic introducer was inserted. A pigtail and a cobra 2 5F catheter were used to obtain angiographies from the abdominal aorta and internal iliac arteries.

Hypervascularization was identified in the pelvic area and early contrast drainage was observed when selective angiographies of the vesical arteries were performed using a 2.7 F microcatheter (Progreat-TERUMO TM) (Figure 1).

Vesical arteries embolization was performed with 600 µm embosphere-type microparticles. Although using delicate manual pressure when injecting the embolizing agent, signs of arterial rupture with free contrast extravasation were detected on the left inferior vesical artery. This was managed with microcatheter traction and more proximal embolization with the same particles. Control angiography demonstrated

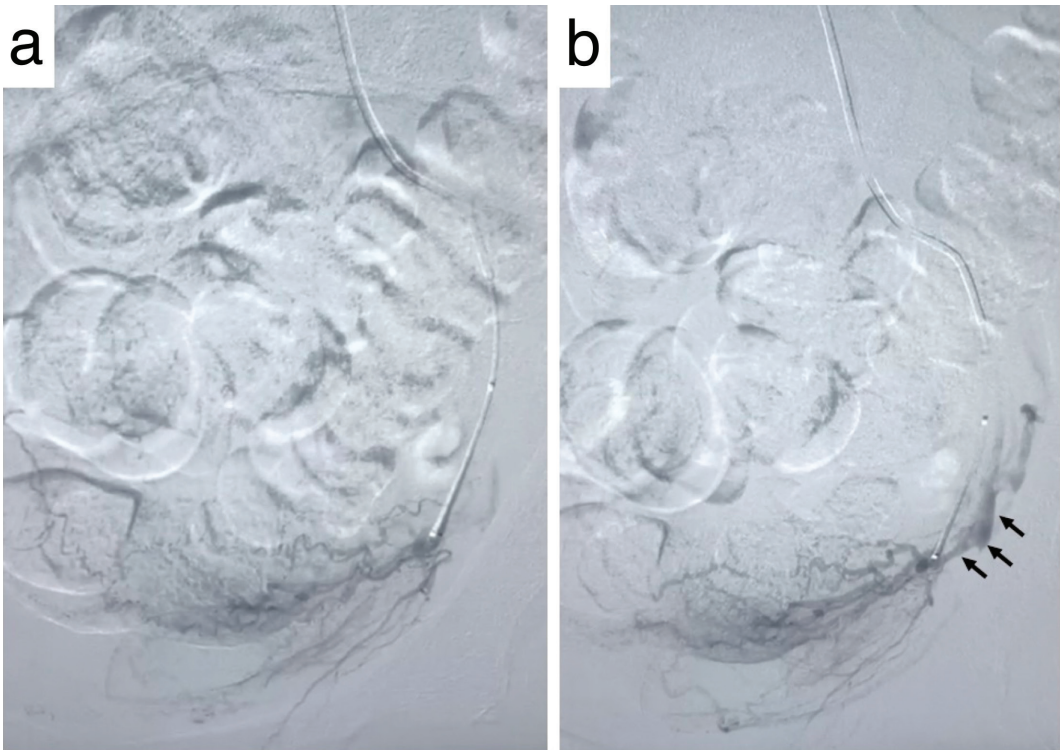

Figure 1 Selective angiography. **(a)** Selective angiography of the left inferior vesical artery. **(b)** Early venous drainage (arrows).

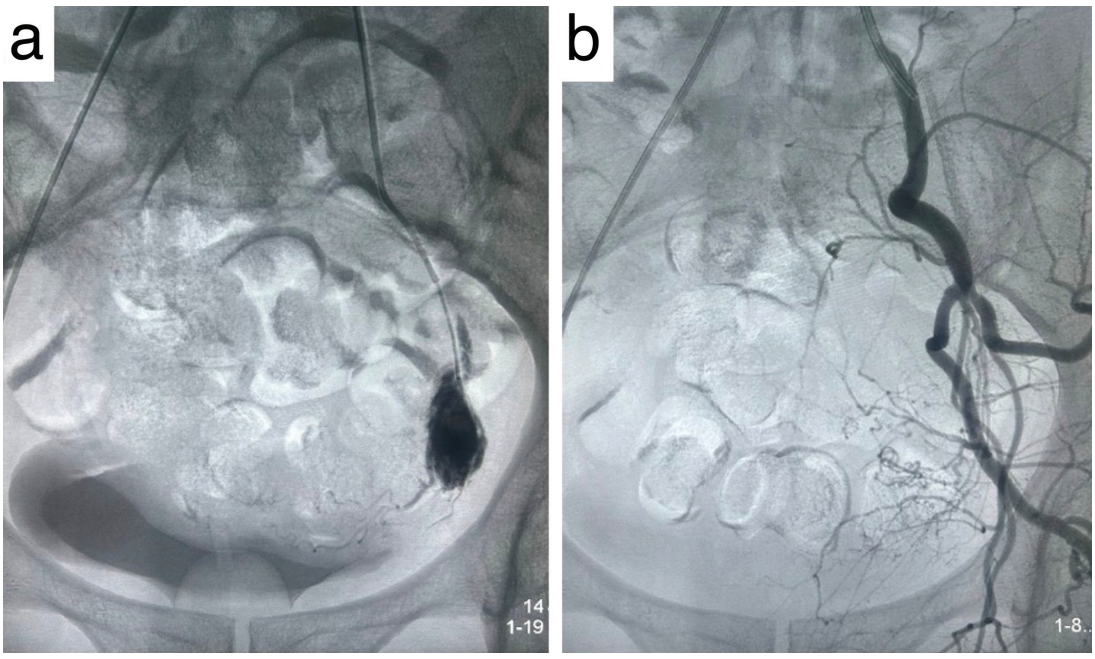

Figure 2 Angiographies. **(a)** Selective angiography of the left inferior vesical artery showing contrast extravasation. **(b)** Angiography of the left internal iliac artery without signs of bleeding after proximal embolization of the inferior vesical artery.

vesical arteries occlusion and no sign of bleeding from the arterial rupture (Figure 2).

The patient was taken to the intensive care unit for postoperative recovery; no prophylactic anticoagulation was administered, but mechanical measures were used for thromboembolic prevention. The patient was discharged from the hospital 24 hours later, with an uneventful postoperative course.

On the first two postoperative days, the patient complained of mild to moderate pain in the lower abdomen,

which improved after symptomatic treatment and was interpreted as post-embolization syndrome.

The patient has been in follow-up for six months and has not required further hospital admissions or blood transfusions; she also reports no new hematuria episodes and a marked improvement in quality of life.

Ethical Approval and Informed Consent

Ethical approval was not required as all data were anonymized. The patient signed an informed consent and endorsed the description of her clinical course for educational purposes.

DISCUSSION

Patients requiring vesical embolization owing to actinic cystitis frequently might already be weakened by anemia or presenting with a compromised clinical status secondary to advanced cancer.

Specially in such scenarios, complex surgical procedures such as radical cystectomy with or without a neobladder creation are associated with high morbidity and mortality rates [3,7,8].

Certain angiographic and technical aspects must be considered when vesical embolization is to be performed.

On each side, the bladder is usually vascularized by a pair of arteries: the superior and the inferior vesical arteries. The inferior vesical artery is a branch of the anterior division of the hypogastric artery. This vessel supplies the fundus of the bladder and, in male patients, also the seminal vesicles, the deferent duct and the prostate are analogous to the vaginal artery in females. Alternative origins of the inferior vesical artery include a common trunk with the superior gluteal and the pudendal arteries or emerge directly from the pudendal artery [9]. In turn, the superior vesical artery gives rise to branches that supply higher areas of the bladder and distal segments of the ureter [1,9,10].

It is of paramount importance to be aware that, in cases of actinic cystitis, the bleeding might be related not only to the vesical arteries, as in the present case, but by anomalous arteries that developed after radiotherapy [2,4,11].

The large number of anatomic variants means that vascular intervention is dependent on identification of signs that indicate which vessels should be occluded. It is more common to identify areas of hypervascularization than clear leakage of contrast; spiral or ecstasia arteries and retention of contrast in terminal branches or precocious venous drainage also suggest a connection with the bleeding [1,9].

Every effort should be made to ensure that bilateral embolization is as selective as possible. Hematuria secondary to actinic cystitis is often associated with bleeding fed by several different vessels, as in the case described here. However, if it appears that only one of the vesical arteries is involved, contralateral embolization can be conducted later, to reduce the risk of necrosis of the bladder [10,12].

Before embolization, the patient should undergo rigorous intravenous hydration; if active intense bleeding is ongoing at the time of embolization, the bladder should be irrigated, and any clots should be removed [8,11,13].

A Foley catheter should be placed and kept "clamped" during the procedure. This will lead to bladder repletion, facilitating the recognition of the target vessels by showing the bladder "silhouette" after super selective angiography, therefore reducing the risk of non-target vessel embolization by mis-identification [4,10] (Figure 3).

While this procedure can be conducted under local anesthesia, the anesthetic technique should be chosen based on the general condition of the patient and the need for their collaboration in terms of remaining still during a procedure with unpredictable duration, since selective vessel catheterization may be challenging [12,13].

A range of different catheters and microcatheters can be used at different stages of the procedure and the choice is influenced by the anatomy of the arteries, by availability and by the endovascular surgeon's preference [5,9].

A great variety of agents have been used for embolizing the vesical arteries. Besides non-absorbable microparticles with diameters calibrated to 300–500 μm and 500–700 μm, as in this case, n-butyl cyanoacrylate surgical glue mixed with lipiodol and coils may be used [1,5,6].

Even though there is no consensus regarding the type of embolization agent, most authors advocate for permanent particulate agents, such as the calibrated microspheres used in the case described here [3,4].

As previously stated, particle sizes ranging from 300 μm to 700 μm are described in the literature for bladder embolization. Because of the authors' personal experience with microspheres for different cases of visceral bleeding, including a previous case of bladder embolization, the option of using microspheres was chosen. The precise size was chosen considering availability and visual evaluation of the diameter of the identified arteries. Based on previous cases using particles of the same size in a wide range of scenarios, the authors strongly believe that the arterial ruptures that happened in this case were much more related to the fragility of the arterial wall, secondary to radiation effects, than to the size of the embolic agents.

When vesical arteries are identified, treatment success can reach up to 90% [9]. Early clinical success is defined as absence of macroscopic hematuria, no formation of intravesical clots, no fall in hemoglobin by more than 2.0 mg/dl and/or failure of more conservative measures for management of hematuria during the first month after embolization. In the case described here, the patient has been in follow-up for three months, without signs of recurrence [6].

Complications related to this procedure include post-embolization syndrome (characterized by self-limiting manifestations of pain, nausea, vomiting and fever)

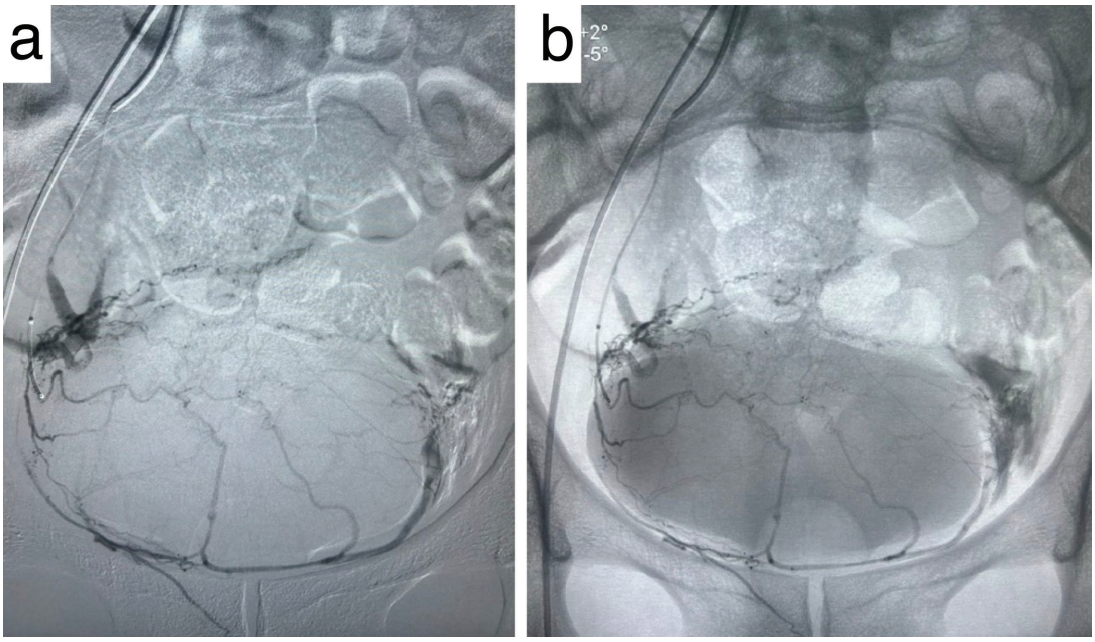

Figure 3 Selective angiography of the right superior vesical artery showing the bladder "silhouette." **(a)** With digital subtraction. **(b)** Without digital subtraction.

urinary incontinence, gluteal and perineal pain, Brown-Séquard syndrome caused by anastomoses between vesical arteries and sacral arteries (which should be screened for during arteriography), gluteal paresis and cutaneous necrosis; bladder necrosis is a possibility, but rarely happens, because of the rich vascularization [9,10] related to arterial anastomosis (Figure 4). More modern studies using selective embolization techniques report complication rates of less than 10% [4,9].

However, studies on vesical artery embolization for bladder hemorrhage using only super selective technique are scarce and patients included in these studies are relatively heterogeneous in the cause of hematuria, including tumors, hemorrhagic cystitis and radiation cystitis. Literature presents technical success rates ranging from 88% to 100%, clinical success from 80% to 100%, and complication rates from 9.1% to 27%; all complications comprising the ones presented above [1,3,8]. An specific search on PubMed using the "(vesical artery [Title/Abstract]) AND (rupture[Title/Abstract])" strategy revealed no case of a vesical artery burst secondary to the embolization procedure, and, to the best of our knowledge, this case report is the first to describe such a complication for this specific procedure.

Our personal experience with vesical artery embolization regards a single case, performed about a decade ago [2], that evolved with urinary incontinence due to detrusor muscle dysfunction.

On the other hand, intra operative arterial rupture might occur, as in the present case. This complication is probably prompted by the combination of chronic inflammation in the arterial wall leading to vascular wall frailty and because an increased flow resistance after distal vascular occlusion occurs secondary to embolization.

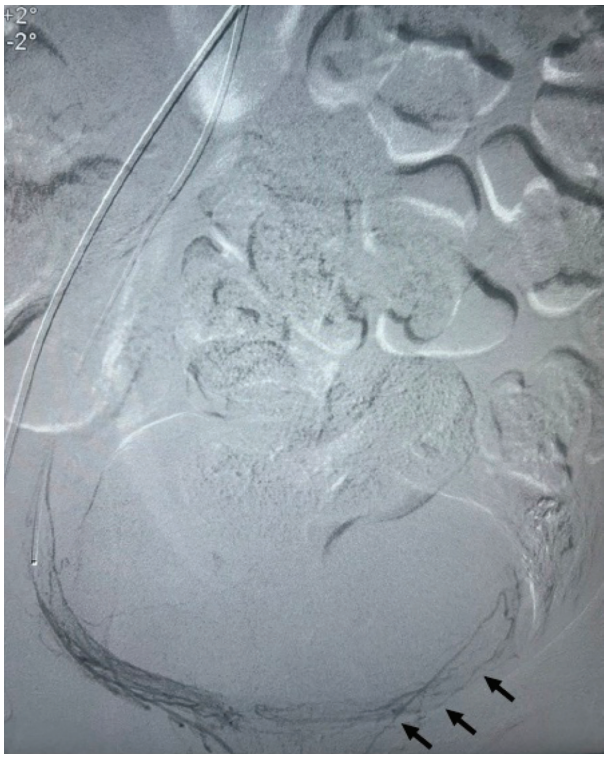

Figure 4 Selective angiography of the right inferior vesical artery showing connections with the left inferior vesical artery (arrows).

To prevent that complication, it is important that the manual injection of the embolizing agent is performed with minimal pressure, but, as in this case, arterial rupture might still occur despite that precaution.

If an arterial burst happens, the first measure should be to access the bleeding pattern and decide how to

manage it. A proximal embolization with micro coils would certainly be an option. However, it was not performed in this case because of lack of availability [1,13].

After a proximal embolization with particles was performed and angiography from the hypogastric artery showed no signs of persistent bleeding, no other procedure was undertaken. Because of the risk of earlier recanalization and secondary bleeding from the ruptured embolized arteries, no prophylactic anticoagulation was prescribed postoperatively [4,6].

CONCLUSION

Embolization of vesical arteries is not frequently performed and literature describing the procedure's technique and its complications is scarce. The procedure can be useful for controlling hematuria due to bladder conditions, such as actinic cystitis, in both elective and urgent settings, and so doctors who treat hematuria cases and those who perform endovascular procedures should be familiarized with this potentially useful procedure.

Ethics Statement

(1) All the authors mentioned in the manuscript have agreed to authorship, read and approved the manuscript, and given consent for submission and subsequent publication of the manuscript.
(2) The authors declare that they have read and abided by the JEVTM statement of ethical standards including rules of informed consent and ethical committee approval as stated in the article.

Conflicts of Interest

At the time this manuscript was accepted, Adenauer Marinho de Oliveira Góes Junior served as Associate Senior Scientific Editor of the journal. They were not involved in any aspect of the peer review or editorial decision-making process related to this submission.

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Author Contributions

All the authors substantially contributed to the study and manuscript writing.

Declaration of the use of generative AI and AI-assisted technologies in the writing process

No generative AI and AI-assisted technologies were used for writing this manuscript.

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