Endovascular management and the risk of late failure in the treatment of ureteroarterial fistulas

George Titomihelakis, MS, Anthony Feghali, MD, Tuong Nguyen, MD, Dawn Salvatore, MD, FACS, Paul DiMuzio, MD, FACS, *and* Babak Abai, MD, FACS, *Philadelphia, Pa*

ABSTRACT

Ureteroarterial fistula (UAF) is a rare and life-threatening source of hematuria. A high index of suspicion is warranted for early diagnosis and timely intervention. Because of high perioperative risk and comorbidities in UAF patients, the endovascular approach has become preferred for repair. Infection can complicate this mode of therapy, and treatment with antibiotics is important. Herein we present five cases of secondary UAFs treated with stent graft alone or stent graft and embolization. (J Vasc Surg Cases and Innovative Techniques 2019;5:396-401.)

Keywords: Ureteroarterial fistula; Hematuria; Stent graft; Endovascular therapy

Ureteroarterial fistulas (UAFs) are a rare life-threatening source of hematuria caused by inflammatory fibrocystic changes leading to pathologic communication between ureters and adjacent iliac arteries (Fig 1, *A*). They are associated with pelvic irradiation, malignant disease, and pelvic-abdominal surgery and are classified into primary (15%) and secondary (85%) lesions. Primary fistulas are seen with aortoiliac aneurysmal disease; secondary fistulas occur after pelvic surgery, ureteral stenting, or vascular surgery.[1,2] Traditionally, open surgical techniques involving ligation of the artery and suturing with a patch graft along with urinary diversion, nephrostomy, or nephrectomy[3] have been used to treat UAF.[4] Iliac artery embolization with bypass[5] and transrenal ureteral occlusion with Gianturco coils[6] are also options. Endovascular procedures have become an alternative to open surgery, given the less invasive nature and complicated anatomic presentation in most patients secondary to previous comorbidity[7] (Fig 1, *B*). There is, however, still concern for infection in patients who are treated with an endovascular approach. In addition, long-term outcomes have included recurrence of hematuria in the first and second year after stent graft placement, with increased recurrence rate in the second year.[8] Mortality rates attributed to UAF are between 10% and 13%, and 22% mortality is associated with hemodynamic instability.[9] Here we describe and review five cases of endovascular repair (Table). The patients described herein have given appropriate consent to have their case details and images included in this case report.

CASE REPORTS

Case 1. A 70-year-old woman with a history of cervical cancer, total hysterectomy, and external beam radiotherapy requiring chronic bilateral ureteral stenting had a right UAF treated 7 years previous to this presentation with coil embolization of the right internal iliac artery and stent graft from the common iliac to external iliac artery; she was taking oral ciprofloxacin for lifelong urinary tract infection (UTI) prophylaxis. Gross hematuria ensued during removal of the left ureteral stent, raising suspicion for a UAF. Ureteroscopy showed pulsatile bleeding below the pelvic brim, and a balloon was inflated in the ureter to tamponade the bleed. Selective arteriography of the left external iliac artery with the balloon temporarily deflated showed extravasation of contrast material into the ureter. Intravenous ciprofloxacin and vancomycin were administered preoperatively, followed by deployment of an 8- × 50-mm Viabahn stent graft (W. L. Gore & Associates, Newark, Del), and follow-up arteriography showed no bleeding in the ureter (Fig 2). The patient was lost to follow-up.

Case 2. A 77-year-old woman with a history of uterine cancer treated 20 years ago with hysterectomy, irradiation, and chronic bilateral ureteral stents developed hematuria during a ureteral stent change. Abdominal and iliac arteriograms were obtained and identified a communication between the right internal iliac artery and right ureter. The patient was successfully treated with coil embolization of the right internal iliac artery, and a 16- × 12- × 70-mm iliac limb stent graft (W. L. Gore & Associates) was placed in the right common iliac to the external iliac artery. Hematuria resolved after endograft placement. The patient had received a 4-week course of ertapenem before the operation for *Klebsiella* UTI, and a 14-day treatment of daptomycin and fluconazole was prescribed for *Enterococcus faecalis* and *Candida* infection that had developed postoperatively. The patient was discharged but died a year later of complications of renal failure. There was no recurrent bleeding, and renal failure was not related to the treatment.

From the Division of Vascular Surgery, Thomas Jefferson University Hospital.

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Correspondence: Babak Abai, MD, FACS, Division of Vascular Surgery, Thomas Jefferson University Hospital, 111 South 11th St, Philadelphia, PA 19107 (e-mail: babak.abai@jefferson.edu).

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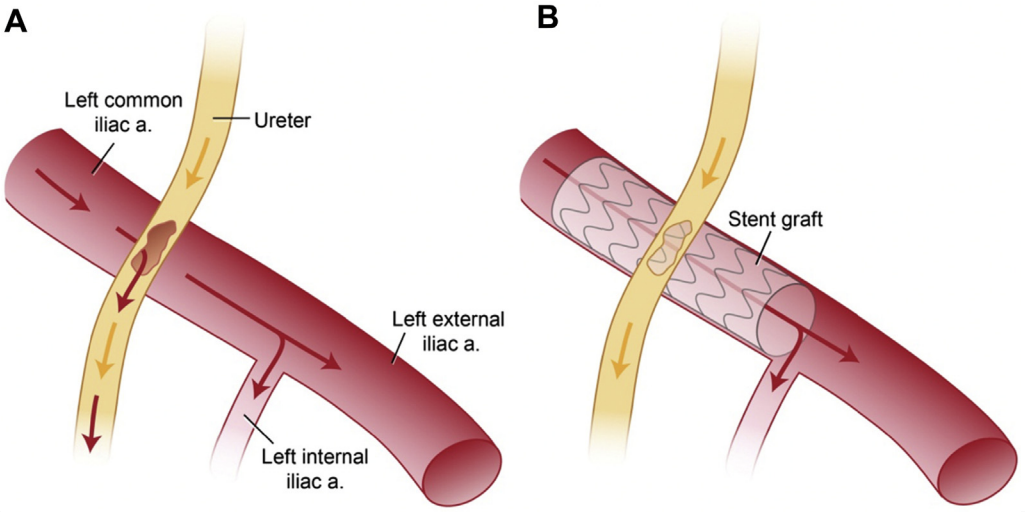

Fig 1. A, Ureteroarterial fistula (UAF) formed between the left common iliac artery and the left ureter with blood flowing into the ureter. **B,** Stent graft placement stopping blood flow into the ureter.

Case 3. A 58-year-old woman with a history of external beam irradiation for cervical cancer 11 years earlier with bilateral double-J stents presented with gross hematuria after having a blood transfusion and bladder irrigation for a similar complaint. Cystoscopy revealed blood oozing from the right ureteral orifice, and subsequent flexible ureteroscopy showed pulsatile bleeding at the site of the iliac artery. Angiography confirmed the UAF, which was successfully treated with a 5- × 22-mm Atrium iCast stent graft (Atrium Medical Corporation, Hudson, NH) deployed in the right internal iliac artery. Hematuria resolved after placement of the stent graft, and the patient remained asymptomatic without recurrence at both 1-month and 10-month follow-up.

Case 4. A 58-year-old woman with a history of ovarian and rectal carcinoma with chemoradiation, total hysterectomy with bilateral salpingo-oophorectomy, and proctectomy with chronic indwelling resonance stents presented with gross hematuria. Retrograde pyelography revealed a right UAF from the right iliac artery to the right ureter; a 9-mm × 10-cm Viabahn stent graft was successfully placed in the right common iliac to the external iliac artery to cover the fistula, and hematuria stopped. The patient was originally treated for chronic pyelonephritis with anidulafungin (Eraxis) for *Candida krusei* infection for 14 days and was also prescribed 7 days of oral trimethoprim-sulfamethoxazole (Bactrim). She received clindamycin preoperatively for surgical prophylaxis along with one dose of aztreonam and vancomycin postoperatively for UTI. The patient returned a year later with occluded right iliac stent with radiographic findings concerning for graft infection and severe acute bleeding from the right percutaneous nephrostomy tube. A Gore Viabahn VBX 11-mm × 7.9-cm stent graft was placed and ballooned proximally with 18F complete seal of the right iliac system. The patient was discharged with treatment for obstructive pyelonephritis of *E. faecalis*, *Proteus*, and *Clostridium difficile*. Oral zyvox and ciprofloxacin were prescribed for 2 weeks, followed by oral suppression with lifelong trimethoprim-sulfamethoxazole. The decision to leave the infected stent graft and to prescribe the patient lifelong antibiotics was made with consideration of the patient's wishes and consultation with the urology and infectious disease services. The patient was asymptomatic and without hematuria at 7-month follow-up (Fig 3).

Case 5. A 56-year-old man with a history of colorectal cancer stage III, resection, chemotherapy, and radiation therapy presented with complications secondary to bleeding from the left internal iliac artery. Significant hematuria was present through a urostomy into an ileal conduit placed in the past; he had undergone stent graft placement in the left iliac arterial system along with coil embolization of the left internal iliac artery. Ampicillin was administered for 14 days starting 24 hours before surgery. Two months after coil embolization, the patient had an infection and underwent combined endovascular and open surgical repair with a right common femoral to left common femoral artery bypass with reverse great saphenous vein. An Amplatzer plug (Abbott, St. Paul, Minn) was placed in the proximal common iliac artery, and the distal external iliac artery was ligated. The patient had bleeding internally 3 months later, and angiography showed common iliac stump blowout. The patient's family decided to institute comfort care measures secondary to his deconditioned state and advanced stage of his cancer, and the patient died (Fig 4).

DISCUSSION

The presentation of UAF involves varying degrees of hematuria, leading to difficult diagnosis. History of intermittent hematuria lasting days to weeks is not uncommon before massive hematuria.[10] Flank or back pain secondary to ureter distention has also been described.[11] Risk factors of UAF include pelvic surgery, radiation therapy, chronic ureteral stents[1,12] (with chronic ureteral stents being the most common in 73.7% of patients[7]),

Table. Summary and outcomes of case reports

Patient	Indication	Site	Procedure	Outcome	Antibiotics and antifungals
1	70-year-old woman with history of bilateral ureteral strictures and previous repair of right UAF	Left UAF	• Coil embolized right iliac • 8- × 50-mm Viabahn stent across defect	Successful repair	• Discharged with oral ciprofloxacin lifelong prescription (UTI prophylaxis) • IV ciprofloxacin (preoperatively) • IV vancomycin (preoperatively)
2	77-year-old woman with history of pelvic irradiation and bilateral ureteral strictures	Right UAF	• Coil embolized • 16-mm × 12-mm × 7-cm Viabahn endograft	Successful repair	• 28-day ertapenem treatment (UTI) • 14-day daptomycin treatment (postoperative infection) • 14-day fluconazole treatment (postoperative infection)
3	58-year-old woman with history of pelvic irradiation	Right UAF	• 5- × 22-mm Atrium iCast stent graft	Successful repair	• Data not available
4	58-year-old woman with history of pelvic irradiation	Right iliac to right ureteral	• 9-mm × 10-cm Viabahn stent graft in right common iliac and external	Successful repair	• 14-day anidulafungin treatment (pyelonephritis) • 7-day oral trimethoprim-sulfamethoxazole (Bactrim) treatment • IV clindamycin (preoperatively) • IV vancomycin (postoperative UTI) • IV aztreonam (postoperative UTI) • Discharged with 14-day oral zyvox and ciprofloxacin prescription • Lifelong trimethoprim-sulfamethoxazole
5	57-year-old man with history of colon cancer with hematuria through nephrostomy-urostomy into ileal conduit	Left UAF	• Multiple coil embolizations and stent grafts • Right common femoral to left femoral bypass • Plugging the left common femoral and amputating the external femoral artery	Tolerated procedure well Returned 2 months later with gastrointestinal bleeding Arteriogram showed bleed from left iliac artery stump Death	• Trimethoprim-sulfamethoxazole (UTI preoperatively)

IV, Intravenous; *UAF,* ureteroarterial fistula; *UTI,* urinary tract infection.

and history of malignant disease (cervical, bladder, and colorectal). Abdominal and pelvic operations were reported in 69.5% of patients, including urinary diversion in 30% of patients. Pelvic irradiation and vascular disease were found in 48.3% and 41.5% of patients, respectively.[7] The patients described herein had many of these risk factors. Angiography can diagnose UAF and allow rapid deployment of an endovascular stent graft with or without coil embolization of the affected vasculature,[12] and cystoscopy can determine laterality of the UAF[7] by showing which ureteral orifice from the bladder is bleeding. Ureteroscopy allows direct visualization of the

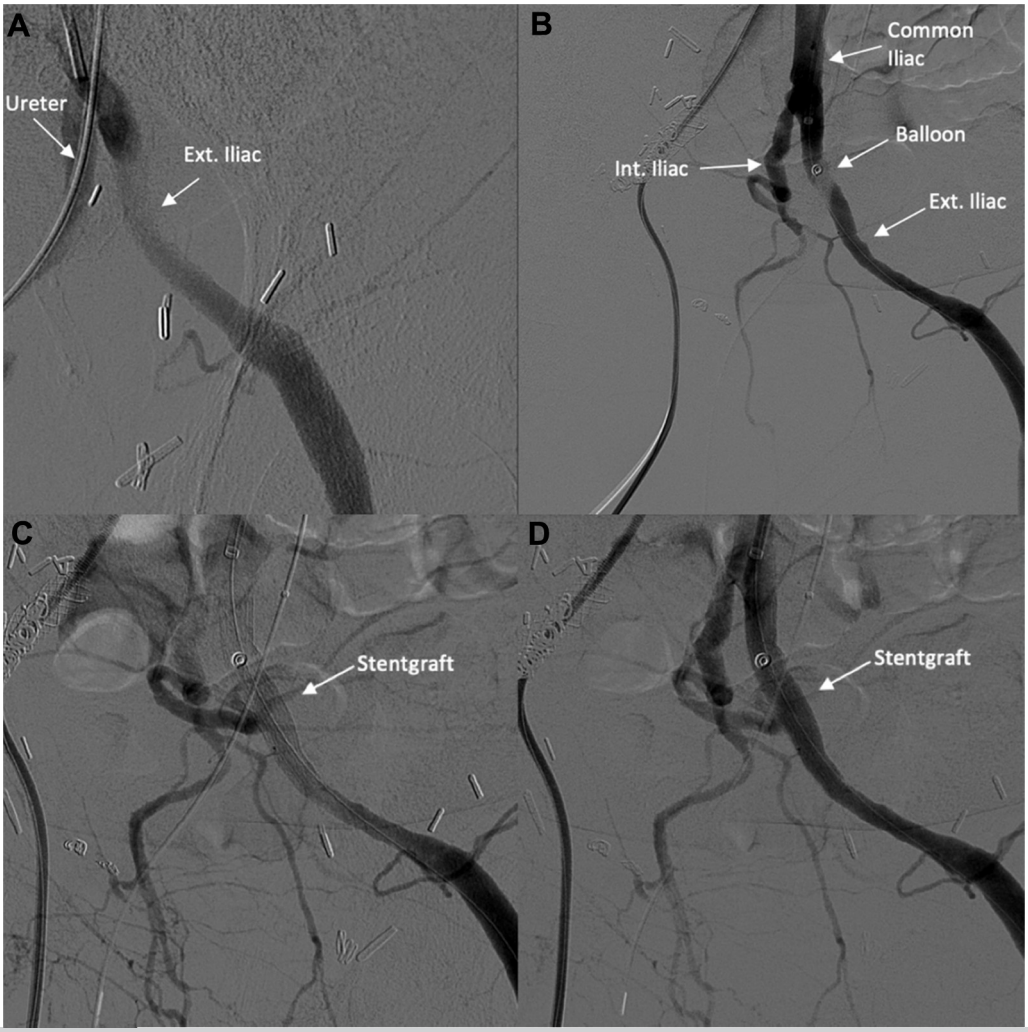

Fig 2. **A,** Extravasation of contrast material from the external iliac artery into the ureter. **B,** Balloon inflated in the ureter to tamponade the bleeding. **C,** Stent graft placed in the external iliac artery. **D,** No further extravasation into the ureter after stent graft placement.

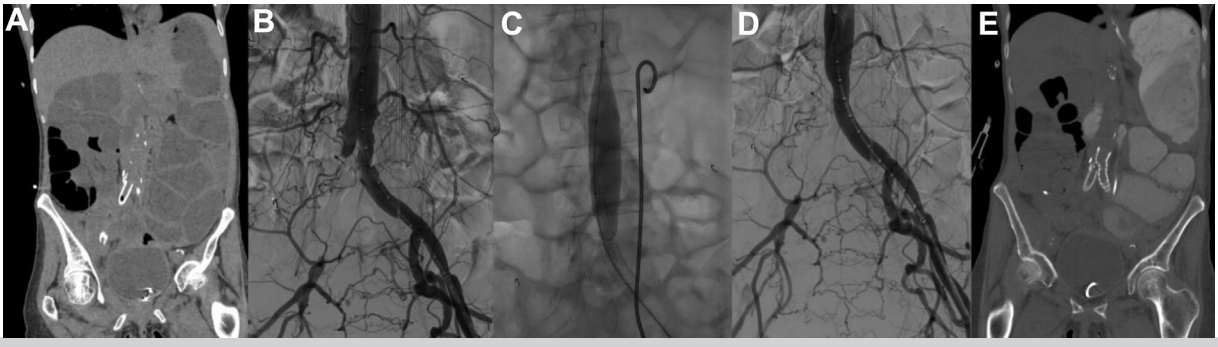

Fig 3. **A,** Preoperative computed tomography scan showing infected right iliac stent graft. **B,** Angiogram showing occluded right common iliac and external iliac arteries, with contrast material filling the infected proximal open portion of the right common iliac artery. **C,** After deployment of VBX stent graft, the proximal part of the stent was ballooned to fit the aorta and to exclude the right common iliac origin. **D,** Completion angiogram. **E,** Postoperative computed tomography scan showing exclusion of the right common iliac origin.

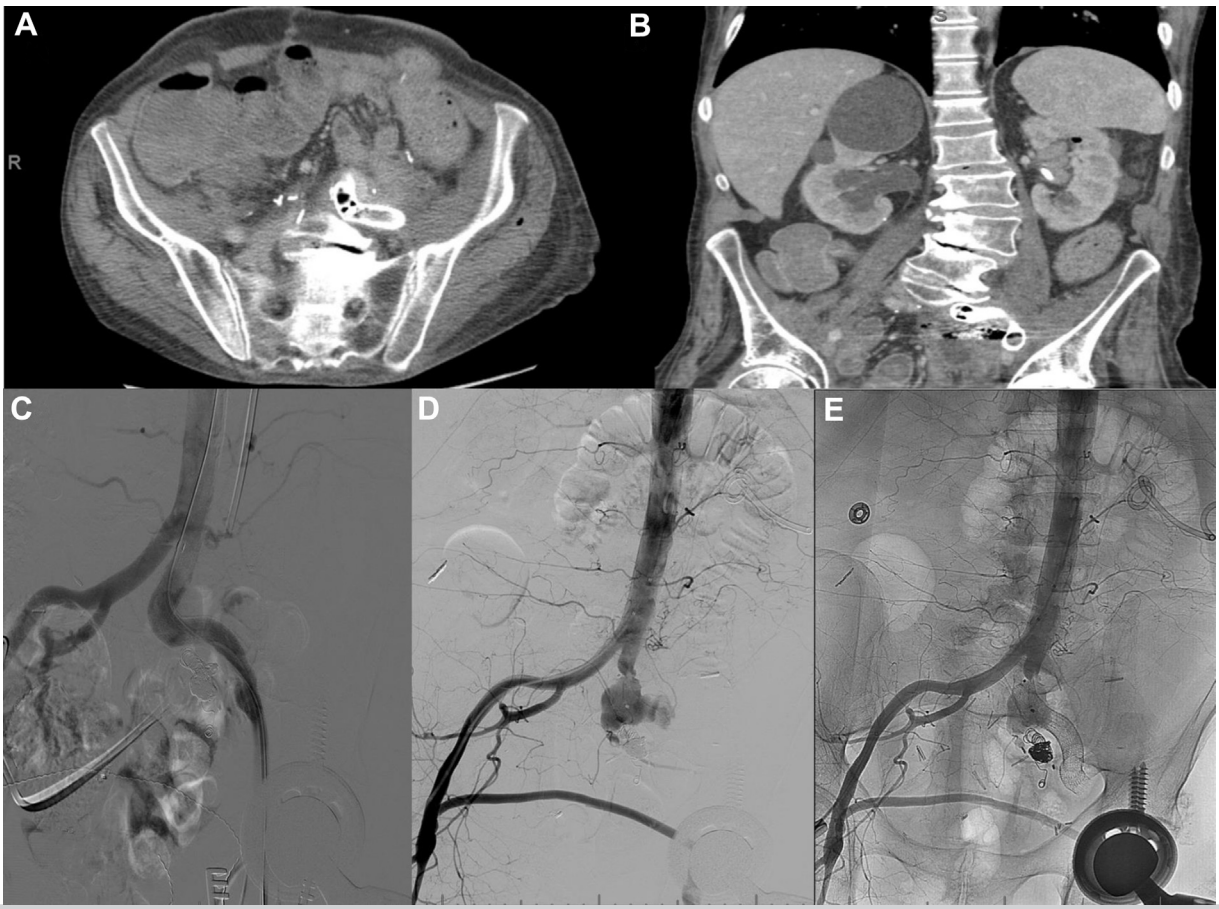

Fig 4. **A** and **B,** Infection after placement of Amplatzer plug, ligation of distal external iliac artery, and femoral-femoral bypass with vein. **C,** Infected endograft after embolization. **D** and **E,** Final rupture that led to the patient's death.

lesion. Pelvic angiography remains the diagnostic method of choice, offering an immediate treatment strategy.[13-15] In cases of uncontrollable hematuria with hemodynamic compromise, endovascular therapy is a lifesaving measure.[14,16]

The potential pitfalls of this procedure include infection, stent thrombosis, and distal embolization. There are no standard guidelines for antibiotic prophylaxis in patients with UAF, but our recommendations are based on review of the literature and the authors' experience.

It is important to consider the patient's medical condition and ability to undergo a high-risk procedure. In a case report by Wang et al,[16] the patient described with an infected aortic endograft underwent washout, was prescribed lifelong antibiotics, and was observed for nearly 2 years after intervention. In another case report by Gharacholou et al,[17] the authors explained that although long-term suppressive antimicrobial therapy for infected endovascular stents has been used, patients with persistent bacteremia or complications from the infected stent may require explantation, and this is currently the standard of care for infected endografts.

A retrospective chart review from 1975 to 2004 described three of eight patients with UAF treated with endovascular stent graft. The authors recommended chronic antibacterial prophylaxis to prevent infection of the stent graft.[18] Infection may also be due to chronic indwelling ureteral stents. Two of the five patients herein described developed infection after stent graft repair. Uroprophylaxis with broad-spectrum antibiotics and antiplatelet therapy are preferred in one retrospective review to avoid long-term lower extremity complications.[19] One report described management of *Klebsiella pneumoniae* with intravenous antibiotics and a 6-week course of oral antibiotics[20] shortly after stent graft placement for treatment of a UAF. Kirksey et al[21] suggested that a course of postoperative antibiotics should not exceed 24 hours following the uncomplicated case of endovascular stent graft placement. Exceptions to this recommendation include cases requiring prolonged use of indwelling catheters and intravenous lines, which may require a longer course of antibiotics on the basis of clinical judgment. Ferrar et al[22] also considered the use of prophylactic antibiotics in stent graft procedures.

Although there is no established consensus for prophylactic antibiotics in patients with UAF and stent graft treatment, we recommend that patients receive antibiotics for 6 weeks after the procedure, and in most cases, depending on the surgeon's discretion, lifelong antibiotics may not be unreasonable. In cases in which the stent grafts become infected, the standard of care should be to remove the foreign body and to perform an extra-anatomic bypass, taking the patient's general medical condition into account.

CONCLUSIONS

UAF is a rare condition, but its incidence is increasing.[23] UAF should be in the differential diagnosis of patients with hematuria, urinary retention, fever, and pain.[9,19] Endovascular therapy is a minimally invasive option that is preferred in these patients secondary to the hostile nature of the open operative field. Infection, secondary to repetitive ureteral manipulation, is a dangerous complication, and antibiotic therapy is recommended. Further studies are required to determine the optimal course of antibiotics. No long-term follow-up has been published to assess the possible complications arising from the technique, such as prosthetic infection, nor have antibiotic treatment protocols been established; thus, long-term follow-up is necessary to determine late complications of endovascular management of UAFs.[24]

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