

# *Embolization with Tornado coils to control bleeding from an arterioureteral fistula*

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*Arterioureteral fistulae are rare, but potentially life-threatening causes of bleeding. We present a case of an 82 year-old woman with refractory, transfusion-dependent bleeding from an arterial fistula to her right ureteral stump, following right radical nephrectomy for advanced renal cell carcinoma. Cystoscopy with retrograde ureteral stump embolization using Tornado*

*(Cook Medical, Bloomington, Indiana, USA) coils plus a slurry of thrombin-soaked Gelfoam (Pfizer Inc., New York, New York, USA) was performed, which led to prompt resolution of the patient's hematuria requiring no further hospitalizations or transfusions. Retrograde insertion of coils and injection of thrombin-soaked Gelfoam can be a minimally invasive, safe, and durable alternative for controlling hemorrhage from an arterioureteral fistula to a ureteral stump.*

**Key Words:** arterioureteral fistula, hematuria, ureteral stump, coils

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## Case presentation and management

An 82 year-old woman underwent open right radical nephrectomy for a 17 cm, stage pT3bN2Mx, poorly-differentiated papillary renal cell carcinoma. The ureteral margin at surgery was negative for cancer. Over the

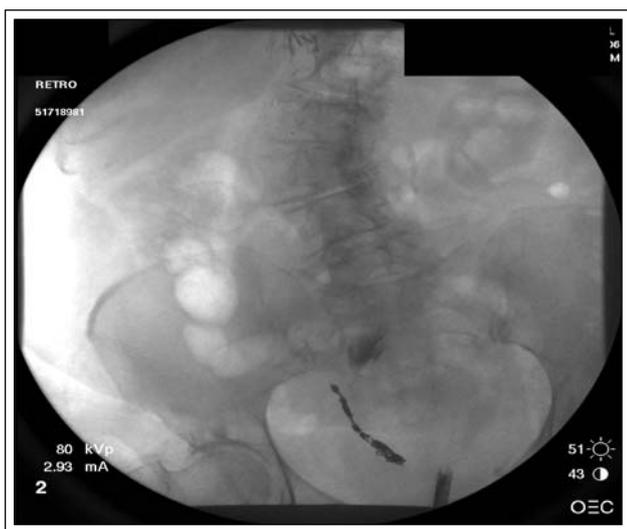
following year, she had progression of disease in her liver, lung and retroperitoneum despite adjuvant sorafenib and elected to stop active therapy. However, 14 months after surgery, she had an episode of gross hematuria with clots, and presented emergently in hemorrhagic shock. Following resuscitation, cystoscopy with clot evacuation demonstrated pulsatile bleeding from the right ureteral stump. Ureteroscopy revealed a solitary site of bleeding at the proximal stump, which was treated with fulguration and injection of Tisseel (Baxter Inc., Deerfield, Illinois, USA). She did well for approximately 3 weeks before she again required

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admission for acute hemorrhage. Over the ensuing week, she received a total of 10 units of packed red blood cells and required rapid continuous bladder irrigation and frequent hand irrigation for clot retention. A second attempt at retrograde fulguration revealed a large arterial communication and failed to control bleeding. She was transferred to our institution for further care. On admission, she was hemodynamically stable with a hematocrit of 32% following 2 units of packed red blood cells en route. Rapid continuous bladder irrigation kept her catheter from clotting. She was alert and comfortable and her abdominal exam was unremarkable. An angiogram was performed, which failed to identify any obvious areas of bleeding for embolization. The next day, cystoscopy revealed a steady stream of pulsatile blood effluxing from the right ureteral orifice. The remainder of the bladder was inflamed, consistent with prolonged catheterization, but no mucosal bleeding was seen. A 5 French open-ended catheter was placed over a wire to the proximal right ureteral stump under fluoroscopic guidance. Through this catheter, eight Tornado coils were deployed into the ureteral lumen, followed by a 20 ml slurry of thrombin-soaked Gelfoam bits, Figure 1. Postoperatively, the patient was placed on slow continuous bladder irrigation. Irrigation was stopped on post-operative day 1 and her catheter was removed on day 2. She received no further transfusions and was discharged home on day 4 with a stable hematocrit of 30%. She remained at home for her final 3 months with no further hospitalizations or transfusions. There were no apparent adverse sequelae from placement of the coils. She died quietly at home with her family.



**Figure 1.** Tornado embolization coils in right ureteral stump.

## Discussion

Arterioureteral fistulae are rare, usually manifesting as intermittent hematuria with significant morbidity and mortality.<sup>1-4</sup> During episodes of hematuria, the bleeding may be massive, with hypotension and shock as seen with our patient.<sup>5</sup> Establishing the diagnosis of arterioureteral fistulae is difficult due to the intermittent nature of the symptoms and the difficulty in identifying the fistula with radiologic studies.<sup>1</sup> Conventional radiologic studies are insensitive in demonstrating the fistulous communication.<sup>2,6,7</sup> Computed tomography of the abdomen and pelvis rarely demonstrate an abnormality.<sup>5</sup> Due to the poor predictability and redundancy of retroperitoneal vasculature, angiography frequently fails to demonstrate the fistulous track.<sup>5</sup> Cystoscopy will localize the bleeding to one of the ureteral orifices. When ureteral bleeding is pulsatile, arterioureteral fistula is likely.<sup>5</sup>

Arterioureteral fistulae can be classified into primary (15%), which are most commonly associated with aortoiliac aneurysms, and secondary or iatrogenic (85%).<sup>5</sup> Risk factors for secondary arterioureteral fistulas include prolonged use of rigid ureteral stents, residual ureteral stump following nephrectomy, vascular reconstructive surgery, adjuvant pelvic radiation therapy for urologic or gynecologic cancers, ureterolithotomy complicated by a urinary leak, or placement of rigid drainage tubes adjacent to the arterioureteral crossing.<sup>1,5,6,8</sup> The pathophysiology is believed to be due to inflammation and/or ischemic injury to the ureter or iliac vessels.<sup>1,5,9,10</sup> Arterial pulsations to a compromised ureter result in pressure necrosis and fistula formation.<sup>1,5,9</sup>

Historically, treatment of arterioureteral fistulas was surgical, with closure of the vascular defect or use of a patch or graft.<sup>1,5</sup> Direct operative repair is associated with a high mortality rate, particularly among high-risk groups such as older patients or those with a history of multiple surgical procedures.<sup>8</sup> In recent years, endovascular embolization or use of a graft-covered stent is favored over surgical repair, although recurrent fistulas have been observed.<sup>5</sup> With all treatment options, hematuria may be effectively stopped, but there has been high postoperative morbidity and mortality.<sup>5</sup> Without intervention, however, the mortality is 100%.<sup>5</sup>

Use of coils has been reported for ureteral occlusion and permanent urinary diversion in the treatment of bowel and bladder fistulas. However, to our knowledge, this is the first report of retrograde,

endoscopic embolization alone to control bleeding from an arterioureteral fistula.<sup>10,11</sup> Inoue et al, reported a case of a 73 year-old woman status-post pelvic exenteration plus right nephrectomy with creation of a left cutaneous ureterostomy, who presented with pulsatile hemorrhage from her ureterostomy. A left nephrostomy tube was inserted and coils were placed in a retrograde fashion through her cutaneous ureterostomy to successfully stop her hemorrhage.<sup>12</sup> Bilbao et al presented three patients who had retrograde ureteral coils placed in addition to endovascular stent placement in an attempt to close arterioureteral fistulae.<sup>10</sup>

In the present case, retrograde ureteral coils with a slurry of thrombin-soaked Gelfoam were able to close an arterioureteral fistula rapidly and durably without further vascular intervention. This palliative intervention permitted the patient to spend the next 2 months at home without a bladder catheter or further hospitalization or transfusion.

We present retrograde insertion of coils and injection of thrombin-soaked Gelfoam as a minimally invasive, safe, and durable alternative for controlling hemorrhage from an arterioureteral fistula to a ureteral stump. □

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