Ureteral Interventions

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ABSTRACT

The pelvic course of the ureter with its close proximity to the iliac artery, pelvic viscera, and other structures predispose to fistula formation. Surgical management of lower urinary tract fistulas is difficult and often ineffective. Nonvascular lower urinary tract fistulas can be managed by urinary diversion with percutaneous nephrostomy to allow for fistula healing. If this fails, ureteral embolization can be very effective; however, this should be preceded by careful evaluation and discussion with the patient as this intervention results in irreversible ureteral occlusion necessitating a diverting nephrostomy catheter indefinitely. A ureteroarterial fistula is a distinct entity compared with nonvascular fistulas with a different approach to management; it can be managed by exclusion of the fistula by endovascular placement of a stent graft across the arterial component of the fistula.

KEYWORDS: Fistula, embolization, ureter, kidney, nephrostomy

Objectives: Upon completion of this article, the reader should be able to describe the interventional radiologic treatment options for ureteral fistulae.

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MANAGEMENT OF URETERAL AND LOWER URINARY TRACT FISTULAS

The pelvic course of the ureter with its close proximity to the iliac artery, pelvic viscera, and other structures predispose to fistula formation. Surgical management of lower urinary tract fistulas is difficult and often ineffective. Nonvascular lower urinary tract fistulas can be managed by urinary diversion with percutaneous nephrostomy to allow for fistula healing. If this fails, ureteral embolization can be very effective; however, this should be preceded by careful evaluation and discussion with the patient as this intervention results in irreversible ureteral occlusion necessitating a diverting nephrostomy catheter indefinitely. A ureteroarterial fistula (UAF) is a distinct

entity compared with nonvascular fistulas with a different approach to management; it can be managed by exclusion of the fistula by endovascular placement of a stent graft across the arterial component of the fistula.

NONVASCULAR URETERAL AND LOWER URINARY TRACT FISTULAS

Nonvascular lower urinary tract fistulas are by far more common than the ureteroarterial variety (Fig. 1). These encompass a wide range of abnormalities depending on the site of fistula formation. Nonvascular lower urinary tract fistulas include ureteroenteric, ureterovaginal, vesicoenteric, and vesicovaginal fistulas. The most common

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Figure 1 Vaginal contrast injection reveals fistula to bladder.

cause is previous lower abdominal/pelvic surgery; trans-abdominal or transvaginal hysterectomy account for nearly 75% of cases.¹ Other common causes include inflammatory processes, such as diverticulitis, pelvic malignancies, pelvic irradiation, trauma, and iatrogenic causes.

Clinical presentation of these fistulas can be varied depending on the exact nature of the fistula. Common symptoms include urine leakage from vagina or rectum, a nonhealing surgical wound, de novo cutaneous ulcers (usually postradiation treatment), abdominal pain, dysuria, flank pain, fever, and fecaluria. The patient may present with recurrent urinary tract infections.

Figure 2 Bilateral nephrostograms delineating the course of the ureters.

Figure 3 Postbilateral ureteral embolization with coils and Gelfoam. Contrast columns are seen in the proximal ureters.

Figure 4 Percutaneous retrieval of an occluded double-J ureteral stent was performed in a female patient at the time of nephrostomy insertion. Pulsatile blood flow can be seen from the nephrostomy access after stent retrieval. A clot in the collecting system is also shown.

Figure 5 Contrast injection through a catheter advanced into the ureter shows filling of the left iliac arteries with fistula to the common iliac artery (arrow).

Figure 6 The ipsilateral internal iliac artery was embolized to prevent an endoleak around the stent graft from retrograde flow.

Figure 7 Angiogram poststent-graft placement (black arrow) showing complete exclusion of the fistula with no residual filling of the ureter. An access wire through the ureter is shown (white arrow).

Good-quality imaging is crucial to confirm the diagnosis and delineating anatomy in preparation for treatment planning. Choice of imaging modality is based on the site of clinical suspicion. Imaging modalities that may be useful include intravenous pyelography/excretory urography, retrograde urography, voiding cystography, and cutaneous fistulography (Fig. 2). However, Computed tomography (CT) urography has now become the investigation of choice in most centers for evaluation of lower urinary tract fistulas. This is particularly convenient as it is quick and relatively comfortable for the patient. CT urography may occasionally fail to identify the exact site of fistula formation. Rarely, urinary tract enteric fistulas may require a contrast enema examination of the colon for diagnosis.

Lower urinary tract fistulas are difficult to treat and can cause significant discomfort and distress to the patient. Surgical repair is often not suitable due to various factors including hostile pelvis related to extensive fibrosis and pelvic malignancy. Treatment strategies include a period of urinary diversion by placement of percutaneous nephrostomy. This will assist the fistula tract in healing over time. This strategy should, however, be altered taking into consideration the potential life expectancy of the patient and the likely length of time required for fistula healing. If more prompt healing is desirable, ureteral embolization should be considered. Several authors have reported excellent results with this procedure using coils and Gelfoam with ureteral occlusion rates approaching 100%.²⁻⁵ As described earlier, this procedure is irreversible and the patient should be

well educated regarding the need for lifelong percutaneous nephrostomies. Ureteric embolization elicits an inflammatory response with subsequent stricturing and fibrosis of the ureter resulting in complete and permanent occlusion (Fig. 3). Based on the exact anatomy of the fistula, unilateral or bilateral ureteral embolization may be required. Nephrostography needs to be performed a few weeks after embolization to confirm adequate ureteral occlusion.

URETEROARTERIAL FISTULAS

An UAF is an abnormal fistulous communication between the ureter and the adjacent iliac artery (Figs. 4–7). The most common site is at the pelvic brim where the ureter crosses the vessel. This can present with varying degrees of hematuria. To date, over 100 cases have been reported worldwide. The incidence of this condition has increased over the past two decades.^{6,7} This may be due to the increasing use of treatments that can increase the risk for this to occur. The condition, though rare, can be catastrophic. Mortality rates ranging from 7% to 58% have been reported.^{7,8} Prompt diagnosis and intervention results in significant improvement in mortality.⁹

Ureteroarterial fistulas can be classified into two groups, primary and secondary.¹⁰ Primary UAF is an extremely rare condition and is caused by erosion of an arterial aneurysm or a vascular malformation into the ureter. Secondary UAF is more common and is invariably secondary to the presence of predisposing factors promoting erosion of the ureteral wall in contact with a pulsating artery. Conditions that predispose to secondary UAF include previous surgery, radiation therapy, and the presence of a long-term ureteral stent. Presentation can vary greatly from minimal intermittent hematuria to catastrophic bleeding. A relatively common scenario is bleeding at the time of routine ureteral stent exchange. Diagnosis will require a high index of suspicion, particularly in patients with minimal symptoms.

Contrast ureterography is often inconclusive, but may show multiple filling defects in the ureter secondary to the presence of blood clots. CT urography may show presence of contrast in the ureter in the arterial phase; however, this is an infrequent finding as the actual size of the fistula is often miniscule. A CT scan also may detect the presence of a pseudoaneurysm of the offending artery. Arteriography is required in all instances to confirm the diagnosis, identify the exact site of fistula, and for treatment. Angiographic findings can vary from subtle irregularity of the vessel to frank extravasation into the ureter. If the initial arteriogram fails to identify the source, provocative maneuvers need to be considered. These include removal of the ureteral stent, if present (to remove the tamponade effect of the stent), while retaining access with a guidewire and irritation of the likely

site of arterial fistula with an angiographic balloon in an attempt to dislodge a clot.¹¹ This maneuver should be performed with great caution with balloon catheters available to allow immediate inflation and tamponade on both the arterial and ureteral aspects.

Treatment of a UAF is by placement of a covered stent graft across the arterial component of the fistula.⁸ This has been shown to be very effective with no increased risk of infection despite the preexisting fistula. Depending on the exact site and vessel involved in the UAF, arterial embolization can also be considered. This technique is more suitable if the UAF arises from the internal iliac artery. Care must be taken to embolize the vessel beyond as well as proximal to the site of the fistula to prevent continued bleeding from retrograde flow in the target vessel.

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