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Percutaneous Ureteral Interventions

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Urinary strictures are commonly managed by interventional radiologists and can result from both benign and malignant etiologies. Many patients end up with lifelong catheters. Although stricture dilation is commonly unsuccessful, some patients can eventually become catheter free. This review describes current outcomes with a variety of dilation and stenting techniques. Management of complex ureteral and urinary complications is also reviewed, including ureteral/arterial fistulas and ureteral embolization for permanent diversion.

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As the conduit connecting the renal collecting system to the urinary bladder, the ureter ensures forward flow and drainage of urine through antegrade peristalsis. Any impedance along the course of the ureter that results in urinary stasis or obstruction increases the risk of infection, stone formation, and renal insufficiency. Ureteral strictures originate from a wide range of etiologies. Benign causes include surgery and/or radiation, inflammatory changes, urinary stones, and iatrogenic and congenital causes. Malignant causes can be from primary ureteral pathology or extrinsic compression of the ureter from adjacent processes.

The ureter has a rich blood supply that originates from multiple feeding vessels originating from the aorta, iliac, renal, and gonadal vessels.[1] As there is extensive collateral flow throughout the ureteral adventitia, compromise of the vascular supply increases the risk of stricture formation. This is of concern in patients undergoing urinary diversion requiring mobilization and reimplantation of the distal ureter to the conduit. Approximately 4%-15% of patients undergoing ureteroenteric anastamoses will develop strictures.[2-4]

Urinary/ureteral fistulas encompass a rare and challenging set of clinical entities that require a multidisciplinary team approach. Patients can present with a wide range of clinical symptoms. Although an ureterovaginal fistula primarily impedes social activities of daily living, an ureteroarterial fistula is a life-threatening emergency with risk of exsanguination. Risk factors for fistula formation include endometriosis, inflammatory bowel disease, pelvic radiation or surgery, and cold knife conization.[1] The knowledge of clinical suspicion for ureteral fistulas is critical for timely and appropriate management of these uncommon and difficult conditions.

Balloon Dilation of Strictures

The gold standard for treatment of ureteral strictures has been open surgical repair, with reported success rates of approximately 80%.[5] However, the associated morbidity and difficulty of open repair has encouraged the development of minimally invasive alternative interventions that lower cost, shorten hospital stay, and provide a safer treatment approach. Initial reports demonstrated varying success rates with balloon dilation of benign ureteral strictures.[4,6-8] These authors demonstrated that the etiology and duration of stricture before intervention are key predictors of dilation success. If a stricture was less than 3 months old before intervention, there was an 88% success rate, whereas those strictures present for greater than 3 months showed a 67% success rate. Furthermore, in those patients who had strictures for over 1 year, success rates were only 15%.[6] Beckmann et al also showed that the subgroup of postsurgical anastamotic strictures had worse outcomes than strictures from other etiologies. These poor results are because of the disruption of blood supply after surgery and ischemic sequelae to the distal ureter. Additionally, follow-up for 1 year or greater demonstrated poor durability even after evidence of initial success.[4] Shapiro et al[4] showed in their series that 55% of those patients who appeared to have been successfully dilated at a 6-month interval follow-up re-stenosed

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within 1 year. Overall, only 16% of their patients remained patent at the 1 year follow-up.

Byun et al[9] furthered earlier studies providing an etiology-based analysis of success rates of balloon dilation. Up to 86% of patients with benign, short-segment strictures (<2 cm) were successfully dilated. They found a statistically significant difference in patients with short vs long segment strictures, and benign vs malignant etiologies. Strictures <2 cm had 56% success rates at 1-year follow-up, whereas none of the strictures >2 cm in length were successfully dilated. When comparing benign vs malignant stricture etiologies, 1-year follow-up after dilation showed a 74% (benign) vs 31% (malignant) success rate for <2 cm strictures. Figure 1 demonstrates a successful high-pressure balloon dilatation of an ureteroenteric stricture. The indwelling retrograde nephroureteral catheter is removed by a wire and contrast injection through a 5 Fr catheter shows an anastamotic stricture. The balloon is positioned over a wire within the stricture and repeatedly expanded with improvement of the stricture. Renal transplant ureters are prone to ischemia due to a disruption in blood supply during harvest and transplantation. Balloon dilation of ureteral strictures and subsequent stent placement has been shown to be effective in the management of transplant patients.[7] Figure 2 shows successful dilation of a ureteral stricture with internalization of drainage with a double J stent.

Studies have demonstrated improvement on initially reported success rates of treatment of ureteral strictures. This progress is due to both advances in percutaneous techniques and developed technologies, as well as improved management of these clinical problems. Balloon dilation is traditionally accomplished with sequential high-pressure dilatation using smooth walled balloons. Cutting balloons were initially introduced for the treatment of in-stent coronary artery stenosis.[10] Extrapolation of this technique to the treatment of ureteral strictures has been described with excellent preliminary results (Table 1).[10,11] Figure 3 shows initial unsuccess-

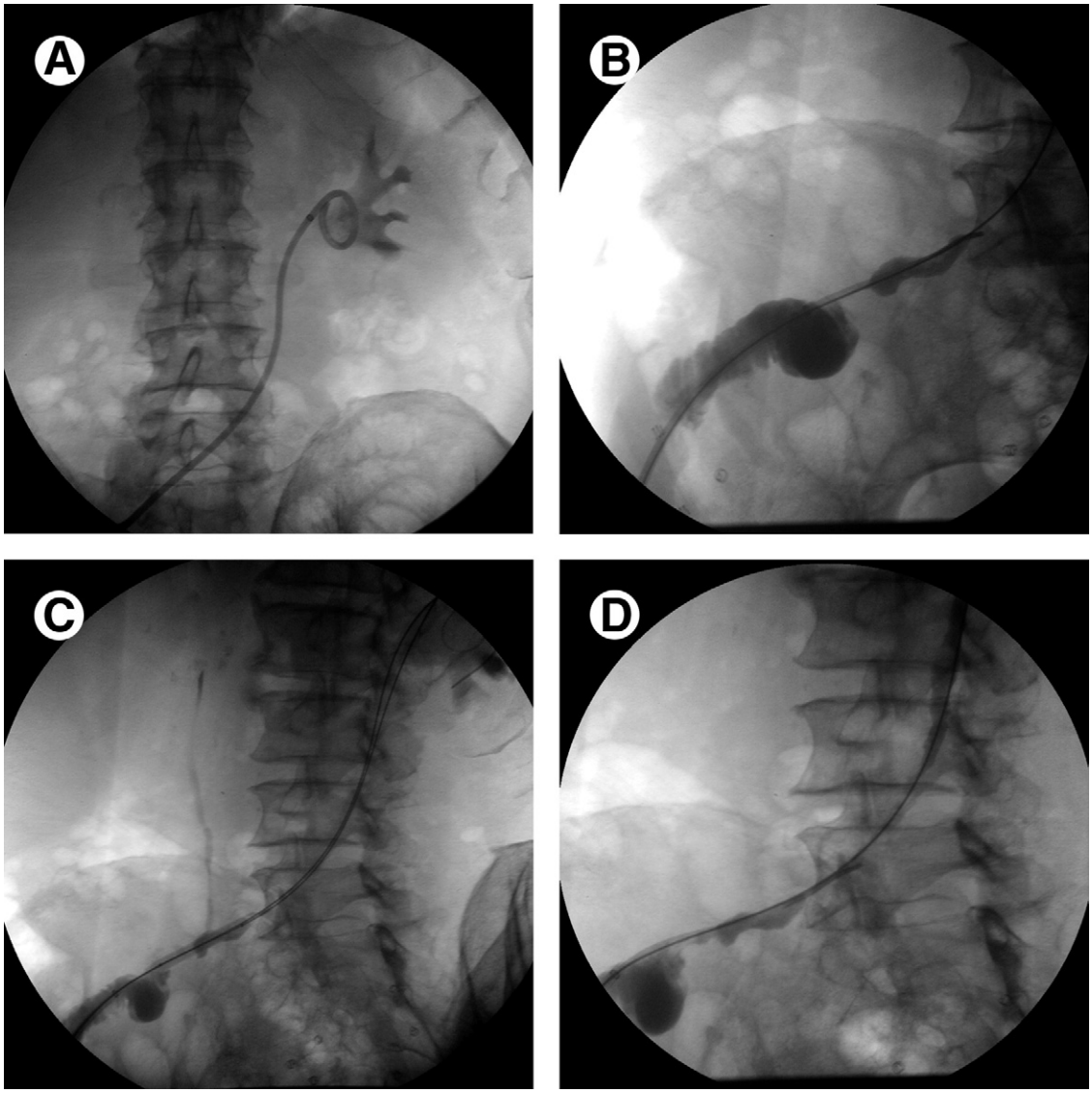

Figure 1 Balloon dilation of ureteroenteric anastomotic stricture. (A) Indwelling retrograde nephroureteral catheter. (B) Severe ureteroenteric stricture. (C) Balloon dilation of the ureteroenteric stricture. (D) Successful balloon dilation with improvement in luminal patency.