

Chapter 5

Antireflux Surgery

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Name of Procedures

1. Ureteral reimplantation
2. Endoscopic correction of vesicoureteral reflux

Lay Description Ureteral Reimplantation

The kidneys drain urine into the bladder via the ureters. Ureteral reimplantation is an operation to correct vesicoureteral reflux (VUR), or abnormal back flow of urine from the bladder into the kidneys. The procedure involves re-tunneling the ureter(s) into the bladder to prevent urinary reflux.

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Lay Description Endoscopic Injection

Endoscopic injection is performed by placing a cystoscope into the bladder through the urethra (urine passage tube), and there is no incision. The procedure corrects reflux by injection of a bulking substance where the ureter enters into the bladder; this prevents flow of urine back into the kidney.

Intended Benefit

There is a natural tendency for reflux to improve or resolve over time; however, there remains a subset of children with persistent VUR or with associated kidney infections who are at risk for potential harm secondary to kidney infection and injury. VUR treatment goals include prevention of febrile urinary tract infections, prevention of kidney injury, and minimizing morbidity of treatment and follow-up [1]. The key focus in selecting patients for surgery is identifying those children unlikely to outgrow VUR and those at greatest risk for recurrent kidney infections [2].

What Happens Before Surgery?

Voiding cystourethrogram (VCUG) is the mainstay of VUR diagnosis, and is most often performed after a child has a febrile urinary tract infection or is found to have hydronephrosis (dilation of the kidney) on ultrasound. Children with bladder or bowel dysfunction (such as infrequent urination, urinary incontinence or constipation) should have those symptoms addressed prior to surgery, as they can lower the likelihood of a successful operation. A urine culture should be obtained before surgery. If this is not possible, a urinalysis the morning of surgery will alert the surgeon to the possibility of bladder infection.

Ureteral Reimplantation

Operative Technique

Open ureteral reimplantation is performed under general anesthesia, and typically takes between 1 and 3 h to complete depending on type of repair, whether it is one or both ureters, and patient age. Various open reimplantation techniques have been described including intravesical (which involves opening the bladder)

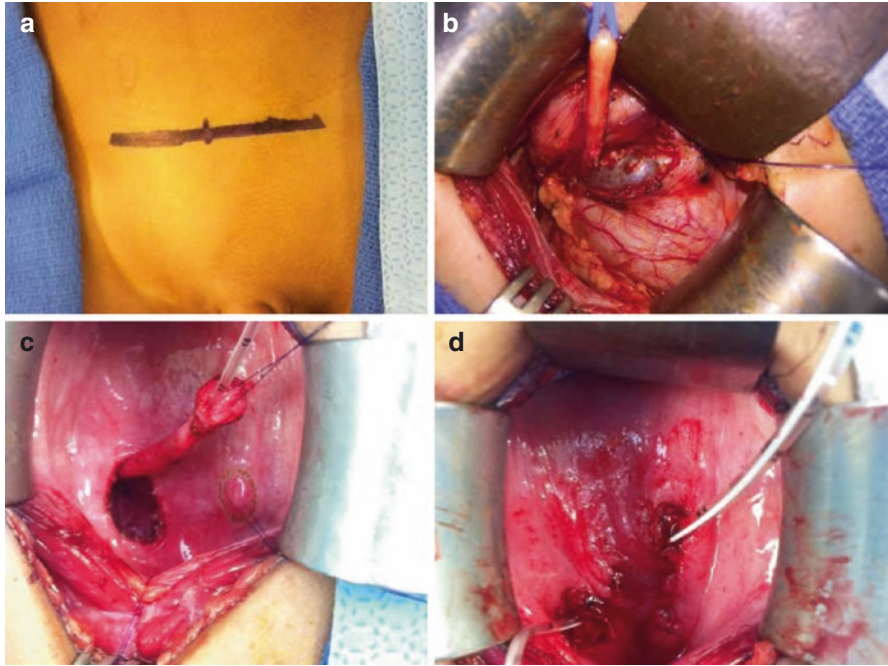


Fig. 5.1 Open ureteral reimplantation. Both intravesical and extravesical approach are via a Pfannenstiel incision (a). With the extravesical approach, the refluxing ureter is *encircled* with a vessel loop. A detrusor trough has been created by incising down to the mucosa, which has not been violated (b). With a Cohen cross-trigonal, the bladder is opened anteriorly and the ureter is mobilized to ensure the tunnel length is five times the ureteral diameter (c). After creation of tunnels, the ureters are approximated to the neo-orifices bilaterally, and feeding tubes temporarily passed to ensure there is no obstruction (d)

and extravesical (tunneling the ureter without opening the bladder) approaches, and are performed through a Pfannenstiel incision, which is a horizontal incision on the lower abdomen just above the pubic bone (Fig. 5.1a). Children receive IV antibiotics and the abdomen is cleansed with an antiseptic to prevent skin infection. After making the incision, the abdominal muscles are split to expose the bladder. The ureters can be re-tunneled into the bladder either by creating muscle flaps to place over the ureter (Fig. 5.1b) or by opening the bladder and creating tunnels from the inside (Fig. 5.1c). Feeding tubes may be temporarily placed to ensure there is no blockage of the ureter after reimplantation (Fig. 5.1d), and sometimes a stent is left indwelling in the ureter for 4–6 weeks to allow proper healing in more extensive repairs. A Foley catheter may be left to drain the bladder overnight, and is removed within a couple of days after surgery.

Expected Postoperative Course

Children are admitted following surgery, and typically have an indwelling catheter until discharge from the hospital. Diet is advanced as tolerated. Patients are often discharged within 48 h after surgery with narcotic pain medication (with or without medicine to prevent painful bladder spasms), and should be kept on prophylactic antibiotics until appropriate postoperative studies are obtained. Children typically miss 3–5 days of school. If an indwelling stent in the ureter is placed at the time of ureteral reimplantation, it is removed via the urethra 4–6 weeks later under general anesthesia.

Follow-Up

Renal-bladder ultrasound should be obtained 1–3 months postoperatively to assess for dilation of the kidney(s). Due to the high success rates of open repairs, postoperative VCUG can be limited to high-risk cases or those with postoperative kidney infection. Children also typically undergo sonography at 1 year postoperatively to assess kidney growth and detect kidney swelling. Routine urologic follow-up with imaging beyond 1 year for uncomplicated ureteral reimplantation in the absence of kidney damage is not warranted [3], however monitoring for late occurring complications of VUR should be performed yearly. Monitoring includes measurement of blood pressure, selective renal ultrasound, and a urinalysis, to assess proteinuria, renal growth, and infection.

Outcome

Success following any antireflux surgery may be based on radiographic (absence of VUR) and clinical findings (absence or decrease in febrile urinary tract infections). Bladder infections after ureteral reimplantation may occur and are of no concern regarding the success of the surgery nor kidney damage. The success rate of ureteral reimplantation is >95% in cases of primary reflux [4]. The most severe form of reflux (grade 5), however, has a lower success rate.

Endoscopic Injection

Operative Technique

Endoscopic injection is also performed under general anesthesia, and often requires approximately 30 min to complete. The child is placed in stirrups, and a small cystoscope is placed into the bladder via the urethra. The injection method

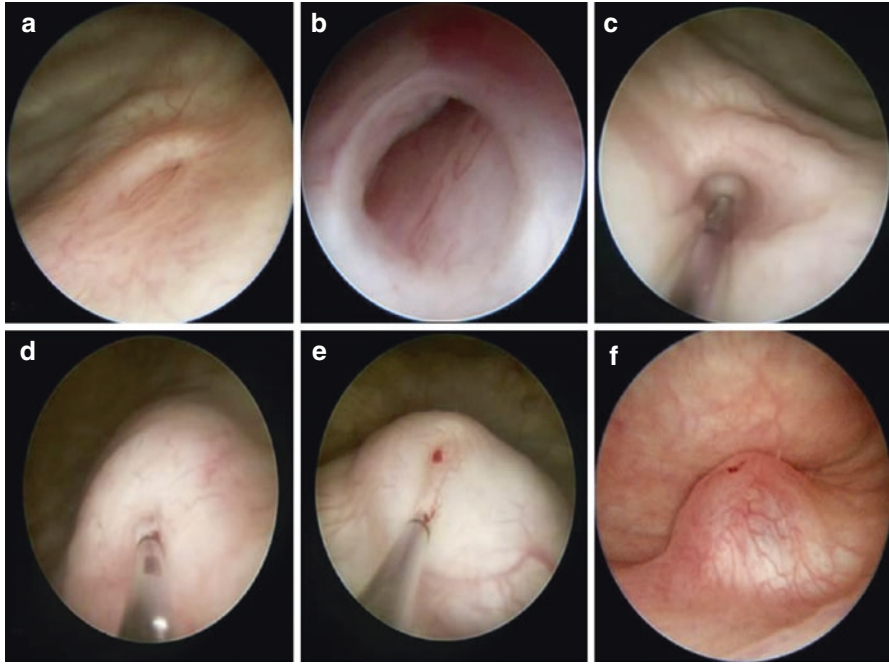


Fig. 5.2 Double HIT Method. Bladder emptied and the ureteral orifice is visualized (a), followed by hydrodistention (b). Proximal HIT is then performed with needle inserted into the mid-ureteral tunnel at the 6 o'clock position (c) and sufficient bulking agent is injected to produce a bulge which collapses the tunnel (d). Distal HIT (e) leads to coaptation of the ureteral orifice (f)

achieving the highest rates of success is the Double HIT [5]. The ureteral orifice (where urine from the kidneys drains into the bladder) is visualized (Fig. 5.2a). Refluxing ureters often hydrodistend, or “pop open” when the flow of saline is directed at them (Fig. 5.2b). A needle is inserted at the mid-ureteral tunnel at the 6 o'clock position (Fig. 5.2c), and bulking agent injected to produce a bulge which collapses the ureteral tunnel (Fig. 5.2d). A second implant is injected within the most distal intramural tunnel (Fig. 5.2e), which leads to coaptation of the ureteral orifice and prevents backflow of urine from the bladder into the kidney (Fig. 5.2f).

Expected Postoperative Course

Children are allowed to go home the day of surgery, after a 1–3 h stay in the post-anesthesia recovery unit. Patients are usually discharged without any narcotic medications, and should be kept on prophylactic antibiotics until appropriate post-operative studies are obtained. Children can return to school and full activities after 24 h.

Follow-Up

As with ureteral reimplantation, renal-bladder ultrasound should be obtained 1–3 months postoperatively to assess for dilation of the kidney(s). While a postoperative VCUG has also been recommended [1], there remains wide variability in success dependent upon the individual patient and the surgeon's clinical experience. Children also typically undergo sonography at 1 year postoperatively. Urologic follow-up with imaging beyond 1 year is patient specific, and not routinely performed in children who are doing well clinically without infections. As above, children with a history of VUR should undergo yearly blood pressure check and urinalysis by their primary care provider. Patients with recurrent febrile urinary tract infection after successful endoscopic treatment of VUR should be evaluated for bladder-bowel dysfunction and recurrent reflux.

Outcome

Endoscopic injection is effective for the treatment of most VUR, however children with higher grades of reflux and those with bladder anomaly or dysfunction may have increased risk of failure. Reported initial success rates, while up to 94 % with the Double HIT method, are known to vary widely among surgeons and techniques [4, 5].

Complications

Complications may occur in the immediate postoperative period or may manifest month to years later. Early complications occur within the first few days following surgical intervention and are typically transient. They include low urine output, blood in the urine (hematuria), bladder spasm, voiding dysfunction and infection [6]. Hematuria and bladder spasms are frequent complications of intravesical ureteral reimplantation and usually resolve within 2 weeks of surgery; while these symptoms can be distressing, reassurance and selective use of anticholinergics are typically all that is necessary.

Ureteral obstruction, or inability of urine from the kidney to drain freely into the bladder, is the most serious surgical complication of reimplantation or endoscopic VUR repair. If low urine output persists beyond 24–48 h after surgery, an ultrasound is obtained to rule out obstruction. Complete obstruction requires placement of a ureteral tube or nephrostomy tube to allow kidney drainage. The risk of obstruction is uncommon (<1 %) after both open and endoscopic repairs [1].

Postoperative reflux may be due to persistent reflux in the reimplanted/injected ureter(s) or new onset reflux into a ureter that was not operated on (contralateral reflux). For open bladder surgery the incidence of persistent VUR is up to 2%.

In almost all cases observation is the preferred treatment as spontaneous resolution occurs over time. Treatment failure following endoscopic therapy ranges from 7 to 50%, and is dependent on technique, VUR grade and surgeon experience [4]. New onset of contralateral VUR has been observed in up to 19% of open unilateral reimplants, with similar rates reported in endoscopic cases [6]. As mentioned, new onset VUR is generally self-limited.

Conclusion

Ureteral reimplantation is a safe and effective intervention for management of VUR. The majority of potential complications are temporary, and managed conservatively during the immediate postoperative period. Endoscopic injection of bulking agents has emerged as a successful, minimally invasive alternative to open reimplantation, with minimal morbidity. Progressive ureteral obstruction is a serious complication of either surgery, and although it occurs in less than 1% of children, it requires intervention with ureteral stenting or nephrostomy tube placement to achieve renal drainage. Families should be counseled about all management options, and treatment should be individualized. When surgical intervention is considered, the consent process needs to include a thorough discussion of the potential risks and benefits of each modality, and an informed decision made based on patient age, health, risk of subsequent renal injury, clinical course, renal function and parental preference.

References

1. Peters CA, Skoog SJ, Arant Jr BS, et al. Summary of the AUA guideline on management of primary vesicoureteral reflux in children. *J Urol*. 2010;184:1134–44.
2. Knudson MJ, Austin JC, McMillan ZM, et al. Predictive factors of early spontaneous resolution in children with primary vesicoureteral reflux. *J Urol*. 2007;178:1684–8.
3. Charbonneau SG, Tackett LD, Gray EH, et al. Is long-term sonographic followup necessary after uncomplicated ureteral reimplantation in children? *J Urol*. 2005;174:1429–31.
4. Sung J, Skoog S. Surgical management of vesicoureteral reflux in children. *Pediatr Nephrol*. 2012;27:551–61.
5. Lackgren G, Kirsch AJ. Endoscopic treatment of vesicoureteral reflux. *BJUI*. 2010;105:1332–47.
6. Arlen AM, Caldamone AA, and Kirsch AJ. Complications of anti-reflux surgery. In: Wilcox DT, Koyle MA, Godbole PP, editors. *Pediatric urology: surgical complications and management* Wiley-Blackwell Hoboken, New Jersey. 2nd ed. 2015.