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Case Report

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Pediatric patient with appendiceal interposition after ureteral stricture

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Abstract

The use of the vermiform appendix as a replacement for ureteral segments has been rarely reported, particularly in children, and even more rarely in the left ureteral stenosis. Herein, a case where the appendix was successfully used to bridge a left mid-ureteral iatrogenic stricture in a child was presented. A two-year-old male with a history of ureteric stone and laser lithotripsy at six months of age presented with ongoing hydroureteronephrosis and recurrent urinary tract infections despite prophylactic antibiotics. Hydroureteronephrosis arose two months after the surgery and progressed slowly. Retrograde pyelogram revealed a stenosis in the left mid-ureter 4 cm above the iliac cross. The mesoappendix allowed the appendix to be used for interposition on the left ureter. The patient was followed with a JJ stent for two months. Ureterorenoscopy during JJ removal showed no stricture. Three years after the surgery, imaging showed improved hydronephrosis, stable function, and no obstructive findings on the nuclear renal scan. Children undergoing stone surgery should be monitored for potential complications, including strictures. Appendiceal interposition should be considered a viable treatment option for ureteric injuries, even for the left ureter.

Keywords: Appendiceal interposition, appendix, iatrogenic, interposition, reconstruction, ureteric stricture.

The use of ureteroscopy for stone has become the mainstay treatment option for children and is considered safe when performed by experienced surgeons.[1] However, it is prone to many complications, including ureteral injury.[2] Therefore, children undergoing stone surgery should be closely monitored for potential complications, despite it being rare, and the presence of postoperative hydronephrosis that does not regress should be considered a warning sign of possible ureteric stenosis.

There are no large series on how to manage iatrogenic ureteric stenosis in children.[3] Adult series recommend endourological procedures for stenosis in short strictures and reconstructive surgery in longer ones.[4] These series mostly include stenosis at the ureterovesical or ureteropelvic junction, where pyeloplasty or ureteroneocystostomy are possible options. On the other hand, Long mid-ureteric strictures require either autotransplantation or interposition with enteric tissue.[5] In those cases, the appendix likely provides the best tissue since it has a similar diameter and peristaltic activity to the ureter. Additionally, its mucosal area is small and does not have any absorption capacity, which prevents electrolyte imbalance.[6] However, its seldom considered on the left side due to possible issues with the mesoappendix. Herein, we described a pediatric case where the appendix was successfully used to bridge a left mid-ureteral iatrogenic stricture.

CASE REPORT

A two-year-old male initially presented with hematuria and a stone in the lower pole of the left kidney and proximal ureter at six months of age. Until the age of two, the patient underwent

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three ureterorenoscopy procedures with laser lithotripsy at another center. The medical records at that time did not contain any analysis about the stone. The follow-up sonography after the removal of JJ stent revealed hydronephrosis, which progressed slowly. He also had recurrent urinary tract infections despite prophylaxis with trimethoprim/sulfamethoxazole. The retrograde pyelogram during the scheduled surgery for the stone revealed a 4 cm stenosis in the left mid-ureter above the iliac cross, and the patient was referred to our clinic with a stone in the left lower pole and proximal ureter, with a JJ stent in place. A written informed consent was obtained from the parent of the patient.

Retrograde repeated pyelogram revealed two strictures in the mid-ureter approximately 3 cm apart. Upon surgical exploration via a left oblique pelvic incision, a 4 cm segment of the ureter was identified as narrow, ischemic, and fibrotic. The gap after its excision was not suitable for anastomosis. The Boari flap was not suitable due to the healthy distal ureter and the extremely large bladder portion if it was planned to cover all the ureter up to the proximal end. Therefore, we decided to use either the appendix or a Monti tube for the ureteral defect. The appendix and its mesentery were of sufficient length, and a 4-cm segment of the appendix was prepared and brought to the left retroperitoneal area by passing it in front of the bowel (Figure 1). Both ureteral ends were then obliquely anastomosed to the appendix, successfully achieving appendiceal interposition (Figure 2).

At the postoperative two-month follow-up, hydronephrosis regressed slowly; therefore, we

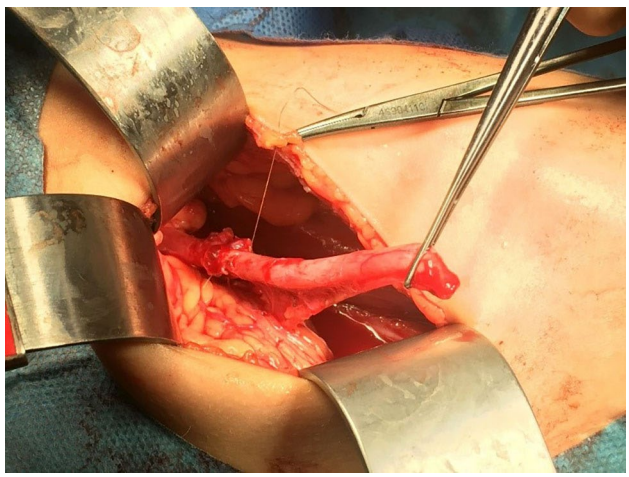

Figure 1. The appendix to be interposed preoperatively was of sufficient length.

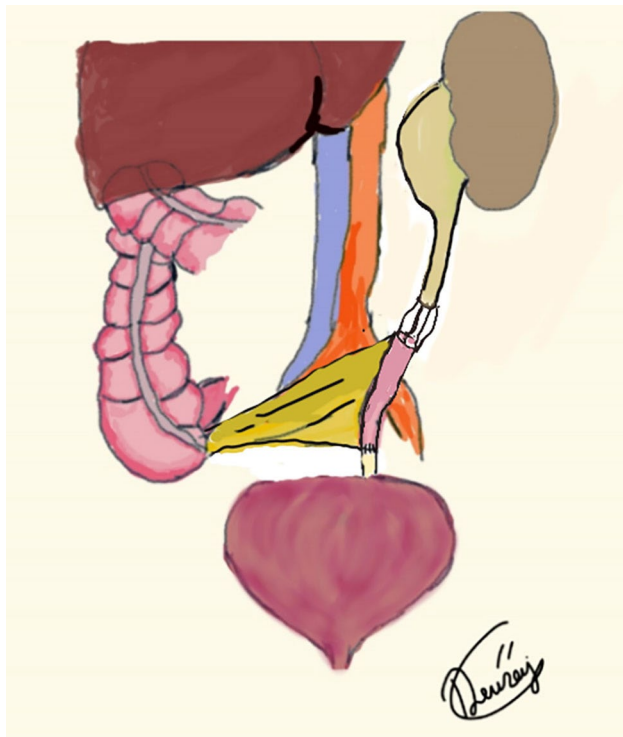

Figure 2. Illustration of appendix interposition.

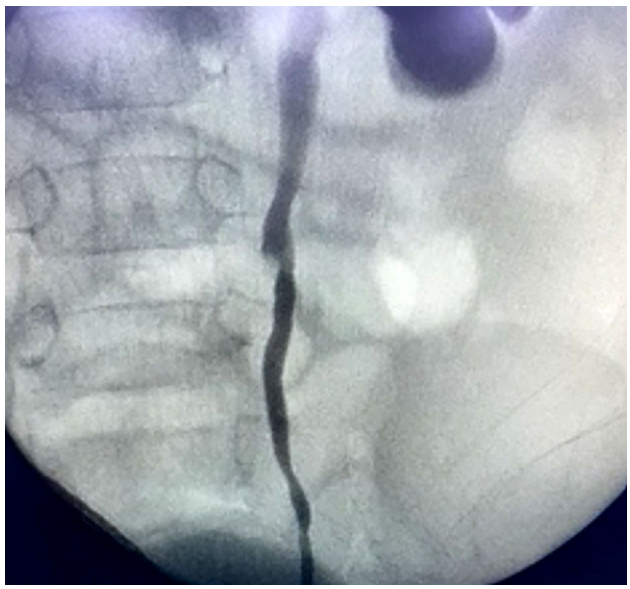

Figure 3. Image of the ureterorenoscopy and retrograde pyelography with no sign of obstruction in the second month.

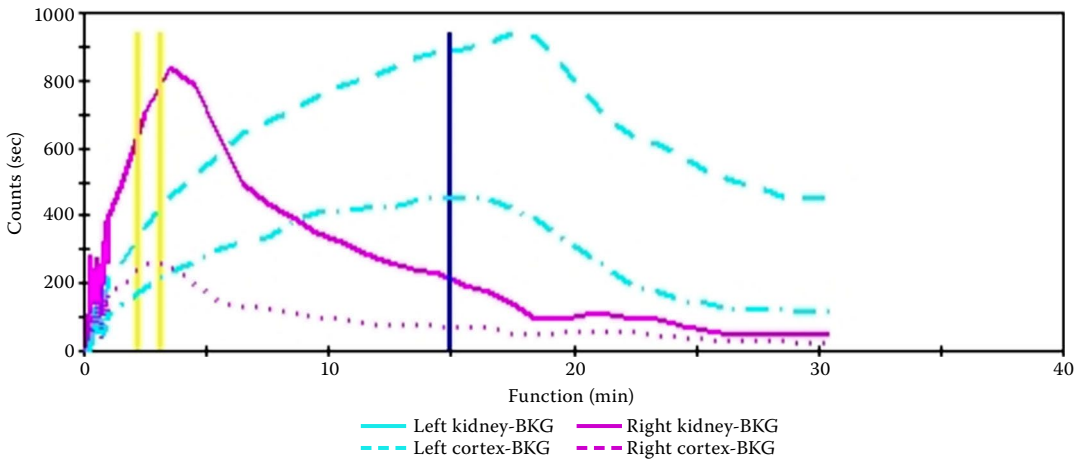

Figure 4. Control MAG3 scan showed no obstruction.
MAG3: Mercaptoacetyltriglycine; BKG: Background.

performed a ureterorenoscopy and retrograde pyelogram, which showed no sign of obstruction (Figure 3). Three years after the surgery, imaging showed improved hydronephrosis. The right kidney had a mildly dilated pelvis, and the left kidney showed dilation in the pelvis, stable function, and no obstructive findings on the MAG3 (mercaptoacetyltriglycine) scan, indicating mild pelvic ectasia (Figure 4).

DISCUSSION

One of the complications of ureterorenoscopy is ureteral stricture.[1] Since the patient's medical history was obtained through medical records, determining whether the etiology of the stricture is due to prolonged stone presence, congenital stenosis, or iatrogenic injury remains speculative. With this case report, we emphasize the importance of postoperative follow-up after endourological surgery in pediatric patients and explore the feasibility of using the appendix for left ureteral reconstruction.

The appendix has a wide range of applications in reconstructive surgery as an interposition conduit. It can be used to create continent stomas, such as the antegrade continence enema (ACE), where the appendix forms a channel for colonic irrigation, and the Mitrofanoff procedure, in which it serves as a catheterizable conduit from the bladder. Additionally, it can be used for ureteral substitution when the native ureter is damaged or stenotic.[6,7] The first case in which the appendix was used instead of the ureter was first reported by Melnikoff[8] in 1912. Despite the improvements in the technique, it is not still frequently used, and there are only small series for children.[9] In addition to its rare use, appendiceal interpositions are mostly performed on the right side. Usage on the left side is technically challenging and has a higher risk of complications, such as stenosis, fistulas, torsion of mesoappendix, and anastomosis leakage.[10-12]

However, alongside these disadvantages, there are numerous advantages, one of the key advantages of using the appendix for ureteral interposition is its anatomical compatibility. The diameter of the appendix closely matches that of the ureter, which can facilitate anastomosis and improve the overall outcome. Additionally, the smaller mucosal surface area of the appendix compared to other intestinal segments can potentially reduce the risk of complications such as mucus production and stone formation. Furthermore, it does not have any absorption capacity, and therefore does not cause electrolyte imbalance.[13]

Considering all the benefits and disadvantages, appendiceal interposition is currently considered an alternative method in the treatment of left ureteral injuries and anatomical pathologies among other treatment options such as psoas hitch

technique, Boari flep, monti tube.[14] Comparisons between these methods are typically based on clinical criteria such as surgical outcomes, complication rates, healing times, and functional recovery. These evaluations may also consider alternative approaches like direct ureteral repair, use of grafts, or stent placement. Overall, the high success rate of appendiceal interposition suggests that it can offer clinical outcomes comparable to, or even better than, other reconstructive options.[5,10,13,15]

In conclusion, the use of appendiceal interposition in pediatric patients and for left ureteral defects is addressed in a limited number of studies in the literature. The reported success rates for this technique are generally high. This approach is considered advantageous compared to other intestinal interpositions. However, given the unique nature of each patient's condition, it is crucial to individualize the treatment approach and tailor it to the specific circumstances of the patient. Consequently, appendiceal interposition should be recognized as a feasible, safe, and beneficial technique for managing ureteric stenosis.

Data Sharing Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

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