Laparoscopic approach for intermittent hydronephrosis caused by primary ureteral fibroepithelial polyps in children

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ABSTRACT

Objective | To summarize the diagnosis and treatment experience of children with intermittent hydronephrosis caused by ureteral fibroepithelial polyp (UFP).

Methods | From 2017 to 2020, cases of hydronephrosis caused by ureteral polyp in Anhui Provincial Children’s Hospital were retrospectively enrolled for investigation. Demographic data, clinical manifestations, operation details, pathology and outcomes were collected from patients’ medical data for analysis.

Results | All seven cases of UFP were boys, including six cases on the left side of the ureter and one case on the right side, at the median age of 7.1 years (3–14 years), with abdominal intermittent pain as the first symptom. All cases underwent laparoscopic pyeloureteroplasty. All the operations were completed successfully; postoperative pathology indicated the presence of primary UFP. Postoperative follow-ups of 1–30 months showed satisfactory recovery and relief from hydronephrosis.

Conclusions | Laparoscopic pyeloureteroplasty or ureteroureterostomy is one of the optimal treatments for ureteral polyp at present. The surgical method should be determined according to the number of polyps, the length and the diameter of the affected ureter, and also the status of renal function of the patients.

INTRODUCTION

Primary ureteral fibroepithelial polyps (UFPs) are mostly benign lesions of the urinary tract. Non-epithelial tumors of mesodermal origin are derived from the mesenchymal tissue instead of the epithelium and account for 20% of all ureteral tumors. In the upper urinary tract, UFPs were thought to be rare, consisting of only 0.5% of all causes of ureteropelvic junction obstruction (UPJO) in the pediatric population. Bilateral incidence is low. The etiology of ureteral polyps is not clear. There are various factors such as genetic factors, irritability, infection, hormone and trauma. UFPs may contribute to UPJO and may result in intermittent hydronephrosis in children. It is difficult to diagnose precisely before operation. Recent studies have shown that as low as 5%–22% of UFPs could be diagnosed without surgery. To better diagnose and treat UFPs in children, pathologically proven cases between 2017 and 2020 were reviewed in the Urology Department (II), Anhui Provincial Children’s Hospital. All cases in the series had undergone laparoscopic surgery and achieved favorable outcomes according to postoperative follow-up.

METHODS

With the approval by the institutional review board of our hospital (online supplemental file 1), a retrospective chart review of pediatric patients who underwent laparoscopic pyloureteroplasty between 2017 and 2020 in our department was conducted. Patients diagnosed as UFPs were enrolled for analysis. The demographic data, clinical symptoms, preoperation findings, operation details, pathological results, and outcomes were collected from patients’ medical data for analysis.
pathology, postoperation complications and outcomes in follow-up were collected from medical records with the approval of patients’ parents. The data were listed as median (range) or listed in tables.

Patients underwent a transperitoneal, three-port laparoscopic approach to resect the ureteral lesion segment. Preoperative catheters were placed, and the affected side was elevated. The left side of the lesion was taken through the mesentery, and the right side was taken through the lateral colon to expose the ureteropelvic junction (UPJ), freeing the ureter along the UPJ, and the ureteral lesion was exposed. The longitudinal incision on the inside of ureter was made to investigate the length of polyp encroachment in the ureter. According to the length of the lesion ureter, the renal pelvis and ureter were freed adequately. Under the premise of no tension on the anastomosis, the segment of diseased ureter was got rid of until the normal ureter without polyp was seen. Lengthwise incision of about 1–1.5 cm was made at the outside lateral edge of the normal ureter. The renal pelvis should be trimmed to facilitate the anastomosis without tension. Ureteropelvic anastomosis was then performed. Before the suture was completed, through the anastomotic stoma, F4 double J was placed into the ureter, and an F10 abdominal cavity drainage tube was reserved at last. An abdominal drainage tube, a catheter and a double “J” were put in the affected side of the ureter in all patients. Each resected specimen was subjected to a pathological examination.

RESULTS
Seven cases of UFPs were enrolled in the study. All of them were boys, including six cases on the left side and one case on the right side; the median age was 7.1 years (3–14 years), with abdominal intermittent pain as the first symptom, accompanied by nausea and vomiting. None of them had gross hematuria and bacteriuria. Two of them had microscopic hematuria and bacteriuria.

Two patients’ intravenous pyelography (IVP) images showed potential UPJO. Only two cases were highly suggestive of UFP preoperation, which showed the typical “earthworm shape” X signs and filling defects in IVP (figure 1). Children with UPJO might merge vesicoureteral reflux (VUR), so voiding cystourethrography (VCG) examination was checked preoperatively in all cases and results were normal. A common feature of all the examinations was that the degree of hydronephrosis decreased with pain relief in the children.

Laparoscopic surgery was successfully completed on all patients. UPJ was located in three cases, and the upper ureter segment was located in four cases. The mean operating time was 204.4 minutes (146–287 minutes), and no perioperative complications were encountered.

Intestinal function was restored within 48 hours after surgery. Urethral catheters and abdominal drainage tubes were removed in 3–5 days after surgery, and double “J” tube was removed 1 month after surgery.

The longest segment of ureteral polyps in the 7 children was 3 cm (table 1), and renal pelvis and ureter could be anastomosed without tension after full release in all cases. We found a single polyp (figure 2A), multiple polyps (figure 2B) and wide-base polyps resembling “octopus tentacles” (figure 2C) in the operations. Postoperative pathology confirmed primary UFPs in seven cases (figure 3), with one case accompanied by the lesions of intrinsic UPJ. The characteristics of UFPs in the seven children are displayed in table 1.

DISCUSSION
Approximately 62% of UFPs occur at the UPJ and the upper ureter. UFPs are more commonly found in boys (usually older boys) and especially predominant on the left side of the ureter. Urinary polyp is one of the causes of endogenous intermittent hydronephrosis, which consists of mesodermal and normal transitional epithelial cells, and it can cause intermittent hydronephrosis, which was first described by Nesbit (1956) in patients who were having acute attacks of pain but whose pyelograms were...
normal between attacks. When ureteral polyp causes ureteral obstruction, it will result in the clinical symptoms of renal colic, like abdominal pain accompanied by nausea and vomiting. These symptoms generally resolve spontaneously and are followed by a pain-free interval that ranges from days to months. Therefore, in such children, we need to exclude the possibility of ureteral calculi, and a biopsy should be performed when intraoperative malignancy is suspected. When ureteral polyp epidermis is erosive and inflamed, hematuria appears; it is difficult to know the cause of hydronephrosis resulting from ureteral polyps before operation by radiological investigations due to the lack of specific diagnostic methods. Retrograde contrast-enhanced angiography and IVP are commonly used in the diagnosis of UFPs. We can see the filling defects in IVP, which is the characteristic X-ray sign of ureteral polyps, because the polyps move with ureteral peristalsis. This image is called “earthworm peristalsis sign”. Two children were diagnosed with this sign preoperation by IVP in our treatment group. Magnetic resonance urography (MRU) is also very helpful in the diagnosis of UFPs. It is less invasive, non-radiating. MRU includes heavily T2-weighted sectional images in orthogonal planes, which allows clear distinction between fluid (bright signal) and tissue (dark signal); the effect should be similar to IVP. All the aforementioned methods to examine polyps need to be identified and diagnosed by experienced doctors.

The treatment of UFPs depends on the location, type (single polyp or multiple polyps) and length of the lesion ureter. Any one of the open, endoscopic, robotic options and laparoscopic method may be available for surgeons to treat UFPs. Open surgery is traumatic and surgical exposure is not superior to that in laparoscopic surgery. Ureteroscopy can be used to diagnose and treat ureteral polyps synchronously and can determine the location, shape and nature of the lesions, making it the preferred treatment. It includes percutaneous antegrade ureteroscopy treatment and retrograde ureteroscopy treatment. Cao et al used staged antegrade ureteroscopy treatment and retrograde endoscopic laser polypectomy in six adults. After 3 months of follow-up, five cases showed favorable recovery, while one case showed deterioration of hydronephrosis due to ureteropelvic stenosis. Percutaneous antegrade ureteroscopy treatment requires the existence of hydronephrosis and the space for operation. For children with intermittent hydronephrosis, this procedure is not appropriate because there is no hydronephrosis during the asymptomatic stage. Moreover, this procedure may cause kidney injury, uncontrolled bleeding and infection. Retrograde ureteroscopy treatment with galvanocautery, laser and biopsy forceps had already been used in adults. Georgescu et al proposed that ureteroscopy should be the gold standard diagnostic method as complete polypectomy could be achieved by ureteroscope approach. Sheng et al treated 25 patients with ureteral polyps by ureteroscopy with holmium (12 cases) or thulium laser (13 cases) resection, which were both considered as effective methods to treat UFPs. Both groups had cases of ureteral stricture, but the thulium method did better in reducing the incidence of ureterostenosis. Kojima et al reported that they encountered the recurrent UFPs after ureteroscopy treatment. Children’s ureters are fine, so laser treatment needs a careful operation, or it may lead

### Table 1 Characteristics of ureteral fibroepithelial polyps

<table>
<thead>
<tr>
<th>Age (y)</th>
<th>Side</th>
<th>Location</th>
<th>Type of polyps (length of poly)</th>
<th>Length of lesion ureter (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Left</td>
<td>UPJ</td>
<td>Two single (0.7 and 0.8 cm)</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>Left</td>
<td>Upper ureter</td>
<td>Multiple, wide base</td>
<td>2.5</td>
</tr>
<tr>
<td>9</td>
<td>Right</td>
<td>UPJ</td>
<td>One single (1 cm)</td>
<td>1.5</td>
</tr>
<tr>
<td>7</td>
<td>Left</td>
<td>Upper ureter</td>
<td>Multiple, wide base</td>
<td>2.2</td>
</tr>
<tr>
<td>14</td>
<td>Left</td>
<td>Upper ureter</td>
<td>Four single (1.0, 1.2, 1.4 and 1.5 cm )</td>
<td>1.5</td>
</tr>
<tr>
<td>6</td>
<td>Left</td>
<td>UPJ</td>
<td>Two single (3.5 and 1.1 cm)</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Left</td>
<td>Upper ureter</td>
<td>One single (0.3 cm), wide base</td>
<td>3</td>
</tr>
</tbody>
</table>

UPJ, ureteropelvic junction.

![Figure 2](image) Different types of ureteral fibroepithelial polyps (UFPs). (A) Single polyp. (B) Multiple polyps. (C) Wide-base polyps.

![Figure 3](image) Pathology confirmed primary ureteral fibroepithelial polyp.
to ureteral stricture at a specified future date. For inexperienced doctors, ureteroscopy in children’s ureters under limited visual field cannot well determine the number and location of polyps, if the polyps wide base or multiple polyps are prone to have a risk of incomplete polyp treatment, ureterostenosis or ureteral perforation. Therefore, ureteroscopy for long ureteral polyps or polyps with wide bases is not good, and for ureteral polyps associated with the lesions of intrinsic UPJ, polypectomy alone will not solve the problem. We reviewed case series of pediatric UFPs since 2003 in the English literature (table 2). From the table, we could find that ureteroscopy was helpful in diagnosing UFPs, but the effect of its treatment was not as effective as pyeloplasty. Osbun et al performed robot-assisted laparoscopic excision to deal with UFPs in four children. The mean duration of the follow-up was 29 months after the operation. All cases had improved their symptoms and reduced degrees of hydronephrosis. However, the popularity of robots in Chinese hospitals is not high, and the cost of treatment is high, which is difficult for parents to accept.

Laparoscopic pyeloureteroplasty is a mature surgical method for hydronephrosis. For children with short polyp segment ureter (<5 cm), this operation may be the first choice of treatment. In this study, the longest ureteral segment of polyps was 3 cm, and after we released the ureter completely, tension-free anastomosis could be performed for all the patients. In our opinion, in the operation of hydronephrosis caused by polyp, the ureter of polyp segment is generally slightly enlarged; the ureter can be transversely cut to expose the polyp first, so as to understand the polyp condition and the length of the polyp segment; the renal pelvis should not be cut too much or not cut, and attention should be paid to protect the blood supply of the ureter when dissociating the ureter, so as to facilitate tension-free anastomosis and postoperative incision healing. Lu et al treated 13 cases of obstruction caused by middle ureteral polyp with laparoscopy and ureteral anastomosis. The median follow-up time was 19.1 months, and the patients recovered well. If the ureter of polyp segment is too long (≥5 cm) and if there is tension or failure of anastomosis during the operation, how should we do in the operation? Renal pelvis flap, Bori flap and intestinal flap have been widely used in the treatment of long ureteral defects. The renal pelvis flap is the preferred method to replace the defect of the upper segment of the ureter, blood supply protection should be paid attention to in the design of cutting, the tubular shape should not be distorted, and there should be no tension when ureteral anastomosis was performed. For the intermittent hydronephrosis caused by ureteral polyp, the dilatation of the renal pelvis is not obvious, so it is necessary to carefully select the pelvis flap to replace the defective ureter. Bori flap is more favorable for the treatment of the lower long ureter defect. Routh et al applied Bori flap laparoscopically to treat the long ureter defect of five children, and the postoperative average follow-up was 3 years. Among them, two had VUR, and the remaining cases recovered well. However, it has been reported that Bori flap can be used to replace the entire ureter. The replacement of intestinal ureter can replace the length of the ureter defect at any site, but postoperative complications, such as mucous obstruction, urinary calculi, urinary tract infection and electrolyte disturbance, may occur, and the long-term complications are irreversible renal damage, and especially the double-focus reconstruction may lead to long-term renal deterioration. At present, ileal replacement of the ureter is considered a mature and effective alternative. The diameter of the appendix tube in children is close to the ureter, and the peristalsis ability can keep the urine unobtainable; the absorption function is low, and the balance of water and electrolytes will not be disturbed, so it is an ideal choice. Wang et al used appendix replacement

Table 2  Case series of pediatric ureteral fibroepithelial polyps (since 2003)

<table>
<thead>
<tr>
<th>Patients (n)</th>
<th>Incidence of preoperative diagnosis (%)</th>
<th>Bilateral (n)</th>
<th>Endoscopic</th>
<th>Pyeloplasty</th>
<th>Recurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adey et al(^{23})</td>
<td>9</td>
<td>25.8</td>
<td>2</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>Niu et al(^{24})</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>Kara et al(^{25})</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Kojima et al(^{12})</td>
<td>14</td>
<td>21.4</td>
<td>0</td>
<td>Y</td>
<td>Y(^{∗})</td>
</tr>
<tr>
<td>Bian et al(^{26})</td>
<td>13</td>
<td>100(^{†})</td>
<td>2</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>Arda et al(^{8})</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>Cattaneo et al(^{8})</td>
<td>1</td>
<td>100</td>
<td>0</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>Ezekiel et al(^{27})</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>Lu et al(^{14})</td>
<td>2</td>
<td>100</td>
<td>0</td>
<td>N</td>
<td>Y</td>
</tr>
</tbody>
</table>

N and Y mean which method the authors chose to deal with UFPs; if they chose endoscopic, it was “Y”; the pyeloplasty line was “N”, and the converse was also true.

\(^{†}\)Endoscopic could diagnose UFPs and then removed them.

\(^{∗}\)Recurrence cases treated with pyeloplasty.
REFERENCES

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文章题目：Laparoscopic Approach to Intermittent Hydronephrosis Caused by Primary Ureteral Fibroepithelial Polyps in Children

承担单位：安徽省儿童医院

一、伦理委员会对该课题方案进行了论证，并特别对以下三方面进行了认真讨论:
1. 研究对象的知情同意；
2. 确保取得同意的措施；
3. 存在的危险与可能的受益；

二、同意实施该课题方案。实施过程中请使用经论证的知情同意书、问卷、说明信等材料。

三、课题方案如需修改，须事先经伦理委员会论证后方可实施。修改内容及其原因需详细备案。

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2021年2月20日