Ureteroscopy in infants and preschool age children: technique and preliminary results

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KEY WORDS

ureteroscopy ◗ infants ◗ children ◗ technique ◗ results

ABSTRACT

Introduction. We present our experience with the use of semirigid ureteroscopy for the treatment of ureteric stones in children less than or equal to 6 years of age.
Material and methods. The records of 21 children (12 female, 9 male) with an average age of 4.7 years (range 8 months to 6 years) treated with semirigid ureteroscopy between June 2006 and July 2010 were reviewed. In 13 ureteral units 7Fr semirigid ureteroscopy was carried out in a retrograde manner to treat stone disease, while an adult ureteroscope (9.5 fr) was used in the remaining patients. Stones were located in the upper ureter in 2 cases, middle ureter in 2 cases, and lower ureter in 17 cases. Ureteral dilation was not required in all patients.
Results. Stone size varied from 4 to 13 mm (mean 6 mm). The management of stones in 18 (90.7%) children was straightforward and a single ureteroscopy was required to clear the ureters. In 2 (6.2%) children, repeat ureteroscopy was undertaken to render the ureters stone free, and in 1 child (3.1%) it was not possible to remove the stone. Stones were fragmented with pneumatic lithotripsy in 12 cases and stones were removed mechanically without fragmentation in the remaining 9 cases. Intraoperative complications occurred in 2 (9.3%) children and included extravasation (1 patient), which was managed with ureteral stenting and stone upward migration (1 patient). Early postoperative complications included pyelonephritis (1 patient). Mean follow-up was 6.4 (3-36) months. Incidence of stricture at the site of stone impaction was not detected in any patients. None of the patients managed without a post-operative stent required subsequent intervention.
Conclusions. In the hands of an experienced surgeon, ureteroscopy in young children can be a safe and efficient treatment for ureteral stones that can be performed without ureteral dilation. Routine ureteral stenting is not a requirement when the procedure is relatively atraumatic. Further studies and longer follow-up are necessary to determine the success of this technique.

INTRODUCTION

The endoscopic treatment of renal and ureteral calculi in the pediatric population has generally been considered challenging and, therefore, reserved as a salvage treatment option of last resort. The refinement of miniaturized ureteroscopes and ancillary instruments has led to the application of ureteroscopy in children in cases in which shock wave lithotripsy (SWL) would have traditionally been considered the first-line therapy. We reviewed our experience with ureteroscopic lithotripsy in patients aged 6 years of age and younger from 2006 to 2010.

MATERIAL AND METHODS

We retrospectively reviewed the records of all patients younger than 6 years old who underwent ureteroscopic intervention with semirigid ureteroscopy at Urology Department, University of Alexandria between June 2006 and July 2010. Patient characteristics were recorded, including date of surgery, age, sex, stone size, location, presenting symptoms, ureteroscopy technique, duration of surgery, the result of surgery, complication, postureteroscopy ureteral stenting, follow-up duration, and final imaging.

Technique of ureteroscopy

All ureteroscopic procedures were performed by 1 surgeon. Under general anesthesia, patient was placed in the lithotomy position. Routine prophylactic antibiotics were administered, all procedures were viewed using a video camera rather than directly through the eyepiece. Fluoroscopic monitoring was made available.

All patients underwent initial cystoscopy to place a safety or working guide wire. After the guide wire was successfully located beyond the stone and into the proximal ureter or collecting system, ureteroscopy was performed with a 6.9 F Storz rigid miniscope (13 procedures), or a 9.5F Wolf rigid ureteroscope (in 9 patients) with a safety wire in place.

The ureteroscope was introduced into urethra, avoiding damage to the penile urethra. Ureterovesical junction (UVJ) dilatation was omitted in all cases. We used a controlled pressurized irrigation device for entry past the UVJ, guided by the safety guidewire, and fine oscillating movements to direct the tip of the ureteroscope into the lumen of the ureter. The ureteroscope was advanced through the ureter with fine movements of the surgeon's hand. The stones were fragmented into several small extractable pieces using pneumatic lithoclast. Most of the fragments were extracted using stone grasping forceps or a 3Fr Segura basket. When the procedure was finished, the guide wire was removed and a urethral catheter was usually unnecessary. A stent was avoided whenever possible. The decision to place a stent postoperatively was based on the duration of the procedure and degree of ureteral trauma. All extracted calculi were sent for analysis and additional medical therapy was provided when appropriate.

RESULTS

A total of 21 children (14 boys, 7 girls) with an average age of 4.7 years (range 8 month to 6 years) were treated with semirigid ureteroscopy. Stone size varied from 4 to 13 mm (mean 6 mm). Of the 21 stones treated, 16, 2, and 2 of the stones were located in the distal ureter, mid ureter, and proximal ureter, respectively. Two patients had previously undergone unsuccessful SWL.

All patients underwent screening for the presence of anatomic and metabolic risk factors. Of the 21 patients, metabolic abnormali-

ties were identified in 10 (47 %) patients. Only 1 patient had an anatomic abnormality – a ureterocele containing a 7-mm distal ureteral calculus. Of the 21 patients, 18 had one stone, 2 had two stones, and 1 had three stones treated. The stones were on the left side in 6 patients and on the right side in 15 patients. None of the patients had bilateral stones.

Ureteral dilation was omitted in all patients. The average operating time was 42.8 minutes (range 25 to 110). In 8 patients, stones were removed mechanically without fragmentation. A pneumatic lithotripter was used in 20 cases.

Ureteral stents were placed postoperatively in 3 (14.2%) of the 21 patients. The decision to omit stent placement was encouraged by the fact the no balloon dilation was needed in any cases with the ease of ureteral access in the absence of ureteral edema and trauma. In those who needed stent placement, one case had intraoperative extravasation and the other two for concerns regarding ureteral edema and stone impaction.

The stone-free rate was assessed radiologically in all patients in the immediate postoperative period. Single ureteroscopy was required to clear the ureters in 18 patients with overall success rate of 90.7 %, 2 patients with a >10 mm distal ureteral calculus required repeated treatment with ureteroscopy to render the ureters stone free, and in 1 child it was not possible to remove the stone due to failure to access. The stones were retrieved for analysis in 20 patients.

In two patients, intraoperative complications occurred – urinary extravasation, which was managed with ureteral stenting in one patient, and stone upward migration in another case. One patient developed pyelonephritis within 48 hours of ureteroscopy despite negative preoperative urine cultures and prophylactic antibiotics and was successfully treated with intravenous antibiotics. Mean follow-up was 6.4 (3-36) months. No incidence of stricture at site of stone impaction was detected in any patients. None of the patients managed without a post-operative stent required subsequent intervention. Ultrasonography showed no sign of any residual stone or hydroureteronephrosis.

DISCUSSION

In the pediatric patient with a symptomatic ureteral stone, SWL has been the preferred first-line therapy, given its minimally invasive nature, since its adoption into clinical practice [1-3]. Although concerns have been expressed about the long-term effects of SWL on developing kidneys, including the risk of hyperoxaluria, renal scarring, hypertension, and subsequent chronic renal failure, they have not been substantiated by most long-term studies of cohorts of pediatric patients [4-9].

Although SWL offers the patient the least invasive modality, it does have some inherent drawbacks. The success of the procedure has varied results, with some large series reporting stone-free rates of between 60% and 87% and retreatment rates of 0% to 36% [10-14]. Most children require general anesthesia for SWL, which means that if SWL fails, the child will again be exposed to general anesthesia to undergo a salvage endourologic procedure. Large stones, cystine stones, radiolucent stones, and calculi situated over the bony pelvis are not suitable for treatment with SWL.

An identifiable metabolic abnormality was present in nearly 47% of the children in our series. The true prevalence in our series was probably greater owing to the false-negative rate associated with the difficulties of performing a metabolic evaluation in young children, especially when they are still in diapers. It is, however, crucial to know whether a metabolic cause for stone disease exists, both in terms of prevention and primary treatment.

Pediatric ureteroscopy requires smaller diameter endoscopes together with lithotripsy modalities that can be passed down small working channels. In our series, all patients were treated with pneumatic lithotripsy, which had great efficacy and safety margin in terms of mucosal injury.

Of the 21 patients, 18 (90.7%) achieved stone-free status. These results compare very favorably with the stone-free rates reported in published studies to date for SWL [10-15]. A review of other series of pediatric ureteroscopy revealed a stone-free rate after one procedure of between 77% and 100% [16-22]. As in our series, most of these patients' stones were located in the distal ureter.

In children, it has been suggested that dilating the ureteral opening may predispose to both vesicoureteral reflux and ureteral stricture [22]. It also usually means that a stent will be needed postoperatively until the edema has subsided. In our series, no case needed balloon dilation thanks to the advent of smaller endoscopic equipment along with a vast array of accessory tools, such as stone baskets and laser fibers.

Stent placement in children leads to discomfort (the "stent syndrome" of frequency, urgency, lumbar, and flank pain) and will necessitate repeated anesthesia for removal unless, as Schuester and coworkers suggested, an external stent string is used, which allows uneventful outpatient removal of the stent [22]. They also stated that they were able to confidently avoid a stent if the procedure took less than 90 minutes and minimal trauma was present at the stone site or in the ureter or kidney. At our institution we tend to agree with their recommendations. We will stent the ureter if ureteral trauma is present, if the stone has been impacted, or if we have balloon dilated the ureteral orifice.

Of the 21 patients in this study, 3 (14.2 %) received a ureteral stent, which was consistent with many reports in the literature. Kurzrock et al. [20] only placed the stent in 29% of their patients for the following reasons: hydronephrosis, edema of the ureteral orifice, and a large stone burden. Shroff and Watson reported stenting in only 4 of 13 patients, but were not explicit about the criteria used to avoid stenting [17]. Some investigators have stated that despite their smaller anatomy, children are able to pass stones more readily than adults [24, 25].

Major morbidities associated with pediatric ureteroscopy are rare. Placing a safety wire when using the semirigid ureteroscope is necessary to maintain access to the upper urinary tract. Few intraoperative complications occurred in our series – one case of ureteral perforation with urinary extravasation (4.7%) and another case of stone upward migration during pneumatic lithotripsy. The rate of ureteral perforation in the cases reported in published studies was 5% of pediatric ureteroscopy procedures, a rate similar to that seen in adults.

Our study had the usual drawbacks of a retrospective review in terms of selection bias, lack of prospective data, and limited follow-up information. Because our institution is a tertiary referral center, we expect to see patients treated at our institution return with post-treatment problems, such as complications or residual calculi.

CONCLUSION

In the hands of an experienced surgeon, ureteroscopy in young children can be a safe and efficient treatment for ureteral stones that can be performed without ureteral dilation. Routine ureteral stenting is not a requirement when the procedure is relatively atraumatic. Further studies and longer follow-up are necessary to determine the success of this technique.

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