



Minimally invasive treatment of pediatric obstructive ureterocele: A 20-year experience

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ARTICLE INFO

Keywords:

Ureterocele
Endoscopic puncture
Duplex collecting system
Vesicoureteral reflux
Minimally invasive

ABSTRACT

Introduction: Ureterocele is a congenital malformation of the urinary tract, characterized by the cystic dilation of the terminal ureter. Its treatment is indicated in symptomatic patients. Over the years, surgical treatment has evolved from open surgeries to minimally invasive procedures. The aim of this study was to assess the long-term outcomes of a case series involving pediatric patients with ureterocele, who were treated using an endoscopic puncture.

Material and methods: A retrospective review was performed of ureterocele patients treated by endoscopic puncture from 2002 to 2021. The primary outcome of the study was relief of the obstruction with a single endoscopic puncture.

Results: From 2002 to 2021, a total of 34 patients with 39 ureteroceles underwent treatment using this technique. The mean age at diagnosis was 16 months. Diagnoses was made prenatally through an ultrasound revealing a dilated urinary tract in 17/34 (50 %) of patients and during the assessment of a urinary tract infection in 15/34 (44 %) of patients. A duplex collecting system was observed in 28/34 (82 %) of patients, while bilateral ureteroceles were found in 5/34 (15 %) of patients. A single endoscopic puncture of the ureterocele proved to be successful in 27/34 (79 %) of patients. A second endoscopic puncture was needed in 4/34 (12 %). Only 3/34 (9 %) patients required a surgical intervention. The mean follow-up period was 4 years.

Conclusion: The results of our study show that endoscopic puncture of obstructive ureterocele is a procedure with excellent long-term results.

Introduction

Ureterocele is a congenital malformation of the urinary tract, characterized by cystic dilatation of the terminal ureter. The incidence of ureterocele is reported to be approximately 1/4000 live newborns, occurring 2–7 times more frequently in females [1,2]. In most cases, ureterocele presents in a duplex collecting system. A single-system ureterocele only presents in 20 % of cases [3]. Bilateral occurrence is observed in 10–15 % of cases. In cases involving a duplex system, the ureter of the upper moiety inserts into the lower and medial bladder, and the obstructive ureterocele presents with a megaureter associated with

upper pole renal dysplasia. The ureter of the lower moiety is inserted higher in the trigone and may cause vesicoureteral reflux (VUR) due to its short submucosal trajectory [1,4].

Currently, prenatal ultrasound enables early detection of ureterocele, before any clinical complication arises [3].

The goal of treatment is to prevent injury to the ipsi- or contralateral kidney associated with obstructive uropathy, VUR, urinary tract infection (UTI), and/or urinary incontinence [5,6]. For children with a non-obstructive ureterocele, without VUR or with low-grade VUR, clinical monitoring with or without chemoprophylaxis may be sufficient [1].

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<https://doi.org/10.1016/j.jpso.2023.100094>

Received 29 August 2023; Received in revised form 29 October 2023; Accepted 30 October 2023

Available online 31 October 2023

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Obstructive ureteroceles require surgical intervention. The conventional surgical approach for ectopic ureterocele with dysplasia of the upper pole consists of a heminephroureterectomy, which carries the risk of injuring the lower pole. Therefore, alternative techniques have been developed that spare the dysplastic upper pole, including ureteropyelostomy or ureteroureterostomy, and ureterovesical reimplantation with reconstruction of the bladder floor [7]. In the 1980s, the first reports of endoscopic treatment of ureterocele in children were published. These proposed a minimally invasive technique involving an incision or opening of the upper part of the ureterocele. This report was followed by other authors who punctured the ureterocele at its base and proximal to the bladder wall, thereby decreasing the occurrence of secondary VUR [8]. This endoscopic puncture was initially used in infants with urinary sepsis and aimed to achieve rapid decompression. Due to the favorable results observed, the procedure was subsequently implemented for the treatment of elective patients.

The question remains whether endoscopic puncture is an effective and definitive therapy in the long-term for most patients [9,10]. Thus, the aim of our study was to assess the long-term outcome of a series of 34 patients with obstructive ureterocele who underwent endoscopic puncture.

Material and methods

An observational, descriptive, cohort study was conducted including 34 patients diagnosed with ureterocele and treated using endoscopic puncture at Dr. Gustavo Fricke Hospital, between 2002 and 2021. The study was approved by the Bioethics Committee of the School of Medicine of the Universidad de Valparaíso (N° 02–2019, October 10Th 2019).

The inclusion criteria were: patients diagnosed with an obstructive ureterocele causing a dilated urinary tract or urinary tract infection. The exclusion criteria were: patients diagnosed with a small ureterocele without ureteral dilation and without symptoms. Such patients were followed expectantly.

The primary outcome of the study was relief of the obstruction with a single puncture. The secondary outcomes of the study were: relief of the obstruction with a second puncture and need for an open surgical treatment of ureterocele after a failed endoscopic treatment.

The following data were collected for each patient: age, sex, medical history, prenatal ultrasound findings, clinical presentation, preoperative workup: ultrasonography, renal scintigraphy, and/or voiding cystourethrogram (VCUG), duration of chemoprophylaxis, age at surgery, clinical and imaging follow-up, and re-interventions. Initially, renal scintigraphy and VCUG were requested for all patients as part of the preoperative assessment; however, this practice changed over time, and such tests were subsequently recommended only for specific cases during the postoperative follow-up, as it did not change the clinical management and radiation exposure was reduced.

Surgical technique

The puncture procedure was performed on an outpatient basis and under general anesthesia by the same surgeon. For intravesical ureterocele, the opening into the ureterocele was made using a 3F ureteral balloon catheter, introduced through a cystoscope. In this case, the point of puncture and electrocoagulation was performed just above the base of the ureterocele. This allowed for one or two punctures to be made in the most distal part of the ureterocele, proximal to the bladder wall and parallel to the floor of the bladder. Care was taken to ensure that the new opening positioned within the bladder was intravesical when the bladder was empty, to avoid obstruction of the bladder neck and to minimize the likelihood of VUR after the procedure. In ectopic ureterocele, it is important to drain the portion of the ureterocele in the urethra in order to avoid the persistence of an obstructing lip at the level of the bladder neck. After the procedure was performed, the opening of the

ureteral lumen throughout the procedure was confirmed under direct vision (Fig. 1).

After the procedure, all patients received chemoprophylaxis with oral cefadroxil at 10 mg/kg/day, were followed-up at the outpatient department and underwent a renal and bladder ultrasonography one month after the procedure. Additional images were only requested based on the need of each individual patient e.g. there was a persistent hydronephrosis, UTI, or urinary incontinence.

Results

Over a period of 20 years, 34 patients with obstructive ureterocele underwent endoscopic treatment. The mean age at diagnosis was 16 months (newborn to 10 years) and 26/34 (76 %) of patients were female.

In 17/34 (50 %) of patients, the initial presentation was a dilated urinary tract on prenatal ultrasound, a UTI in 15/34 (44 %) patients, and a ureterocele with a dilated urinary tract as an incidental imaging finding in 2/34 (6 %) patients (Table 1). Four patients had associated malformations, which included contralateral primary obstructive megareter, anorectal malformation, obstructive hypertrophic cardiomyopathy, and omphalocele.

The preoperative workup included a renal and bladder ultrasound that was performed in every patient revealing a duplex collecting system in 28/34 (82 %) patients and bilateral ureterocele in 5/34 (15 %) patients, resulting in a total of 39 affected renal units. Renal scintigraphy was performed in 26/34 patients, of whom 14/26 presented with a poorly functioning upper pole. Voiding cystourethrogram (VCUG) was performed in 14/34 patients, of whom 6/14 had VUR of grade III or greater.

The mean age at endoscopic puncture was 26 months (1 month to 10 years). No intra or postoperative complications were observed.

During the clinical follow-up, 16/34 (47 %) patients presented with at least one episode of UTI within the first year after the procedure. All patients who had a UTI underwent a VCUG in order to assess the presence of VUR, leading to the diagnosis of VUR grade III or greater in 6/16 patients. Only 2 out of this 6 patients with high grade VUR were operated on. The four remaining patients with a UTI and high grade VUR did not require any surgical procedure on long-term follow up.

Endoscopic puncture proved successful and was the definitive long-term treatment in 27/34 (79 %) patients who underwent endoscopic puncture, who had only one or no episodes of postoperative UTI.

In 4/34 (12 %) patients, a second puncture was performed because of febrile UTI and persistent urinary tract dilation on ultrasound. This second puncture solved the medical problem in all four patients.

In 2/34 (6 %) patients, extravesical ureteral reimplantation (Lich-Gregoir) was performed due to persistent febrile UTI and high-grade VUR on VCUG. In addition, 1/34 (3 %) patient was operated on at another center where an upper polar heminephrectomy was performed because of a poorly functioning upper pole according to their guidelines (Table 2).

The mean time of follow-up was 4 years (1 to 16 years) and the mean duration of postoperative chemoprophylaxis was 8 months (1 month to 3 years). In 2/34 (5 %) case, post-puncture urinary incontinence was reported, which resolved spontaneously in one patient and required pelvic floor physical therapy in the other patient.

Discussion

The increased use of ultrasound monitoring of pregnant women has facilitated the prenatal detection of hydronephrosis, leading to the early evaluation of urological malformations, including ureterocele. After birth, UTIs remain the most common reason for screening [11].

Endoscopic management in patients with ureterocele has been modifying the conventional surgical approach as the treatment of choice, as it is a simple and effective management solution. Initially, it

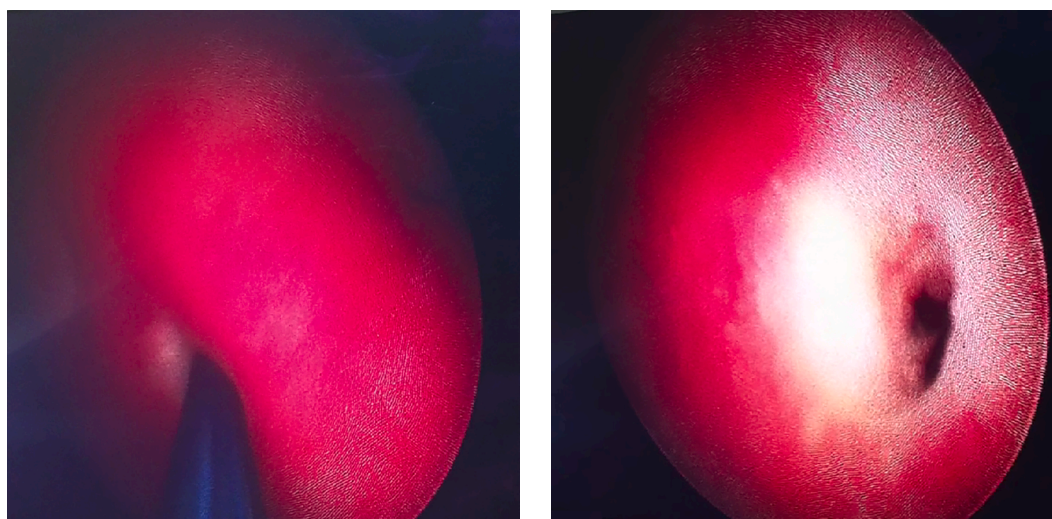


Fig. 1. (a) Intraoperative image of the puncture of the ureterocele with electrocoagulation (b) Postpuncture image of the orifice at the base of the ureterocele. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

Table 1

Demographics of patients with ureterocele requiring treatment.

	Number of patients, n (%)
Mean age at diagnosis	16 months (newborn to 10 years)
Gender (male/female)	8/26
Diagnosis:	
1 Prenatal dilated urinary tract on ultrasound	17/34
1 Urinary tract infection and dilated urinary tract	15/34
1 Dilated urinary tract as an incidental finding on ultrasound	2/34
Associated malformations	4/34 (12 %)
Duplex collecting system	28/34 (82 %)
Bilateral ureterocele	5/34 (15 %)

Table 2

Long-term results of endoscopic puncture of ureterocele.

	Number of patients, n (%)
Relief of obstruction with a single endoscopic puncture	27/34 (79 %)
Relief of obstruction with a second endoscopic puncture	4/34 (12 %)
Extravesical ureteral reimplantation	2/34 (6 %)
Upper polar heminephrectomy	1/34 (3 %)

was indicated in patients who presented with urosepsis secondary to obstruction who required emergency drainage[10]

Endoscopic laser-puncture or electrosurgical incision are the most commonly used minimally invasive approaches for the treatment of the ureterocele[17]. Both techniques are successful in decompressing ureteroceles, but the consequence of such treatments may be formation of de novo vesicoureteral reflux and febrile urinary tract infection which could impact the final results[16]. The minimum number of holes required for adequate decompression of the ureterocele during the laser-puncture technique is not known and is still a matter of debate [15].

At our center, 1 or 2 endoscopic electrosurgical puncture is the treatment of choice for patients diagnosed with obstructive, ectopic or orthotopic ureterocele requiring intervention. This minimally invasive technique is a procedure that is feasible to be performed in very young patients, on an outpatient basis or with a short hospital stay. The primary goal is to quickly and effectively decompress the ureterocele, to reduce the dilatation of the affected ureter, thereby diminishing the risk of pyelonephritis and contributing to the preservation of kidney

function. If further intervention is required, it allows for open surgery in older children.

Ureterocele puncture has been reported to achieve decompression in the short-term follow-up period, restoring the normal anatomy of the trigone and avoiding conventional surgery in up to 89 % of patients affected, similar to the results observed in our current series [12,13]. However, there is still controversy regarding the long-term outcomes of ureterocele puncture as a sole and definitive procedure [10]. Our study demonstrates that effective decompression with 1 or 2 endoscopic punctures was observed in a long-term follow up in the vast majority of patients, obviating the need for conventional surgery. The need for re-puncture is not associated with comorbidity for the patient.

Therefore, we decided not to perform pre-puncture nuclear medicine studies, requesting them only in patients presenting with febrile UTI or persistent ectasia. This approach is particularly important considering that an atrophic or poorly functioning renal pole, which is uncomplicated, tends to resolve during follow-up.

Spontaneous resolution of VUR following endoscopic puncture has been reported in up to 60 % of cases [10,12,14]. Based on our results, we have reconsidered the employment of VCUG as a preoperative assessment tool, recommending its use only for selected patients during postoperative follow-up if there are any indications suggestive of persistent VUR following endoscopic treatment, in order to avoid unnecessary irradiation.

The limitations of the current study are that it is a descriptive, retrospective study that lacks a control group. Patients were collected over a long period of time, therefore not all of them underwent the same preoperative or postoperative studies.

Conclusion

Endoscopic electrosurgical puncture is an effective option for the treatment of obstructive ureterocele without associated morbidity. The results of our study show that endoscopic puncture proved to be a simple, low-risk procedure without complications. Endoscopic puncture has shown to be useful not only for infants with urosepsis, but also for the elective and definitive long-term treatment of ureterocele.

CRedit authorship contribution statement

Mónica Quítral V: Conceptualization, Formal analysis, Writing – original draft. **José A. Mena D:** Data curation, Formal analysis, Writing – original draft. **Loreto Manríquez C:** Data curation. **María José Mela**

S: Conceptualization. **Romina Ammann R:** Data curation, Writing – original draft. **Louise Navarrete M:** Conceptualization. **Sandra Montedónico R:** Project administration, Writing – review & editing.

Declaration of Competing Interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

Dr Sandra Montedónico, corresponding author serves as a reviewer for the Journal

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