

## Endourology Techniques in Children: Experience of a Nord African Center

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### Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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### ABSTRACT

**Introduction:** Bladder endoscopy in children has been improving over the last few years because of the miniaturization of the instruments. It seems to be now the method of choice for the diagnosis and the management of many pediatric diseases with low morbidity and excellent results.

The aim of our study was to discuss the role of cystoscopy in pediatric surgery and to overview its future prospects.

**Methods:** Between January 1st, 2019 to December 31, 2019, patients who underwent a cystoscopy were reviewed retrospectively. This monocentric study has been conducted by the department of Pediatric Surgery in Habib Thameur Hospital., Tunisia.

**Results:** 39 males and 27 females were included in our study. The average age was three years. The different etiologies were: the vesico-ureteral reflux in 29 patients; pelvi-ureteric junction obstruction in 22 patients, ureterocele in 4 patients, posterior urethral valves in 2 patients, megaureter in 2 patients, and others in 7 patients. The endoscopy was performed for a therapeutic purpose in 60 cases and for a diagnostic one in 6 cases.

The endoscopy made it possible to diagnose a bladder tumor and to perform a biopsy, to investigate hematuria or a gender ambiguity, or to exclude the diagnosis of urethral valves. The urethrocytoscopy was performed for the injection of Deflux®, the treatment of posterior urethral valves, and ureterocele. It was also used for placing or removing JJ stents.

**Conclusion:** Many instrumental innovations have expanded the indications for bladder endoscopy in children. The field of robotics is also knowing as a big expansion with a high precision of work and great results but the high cost of these technics remains a big challenge in our country.

*Keywords: Uropathy; malformations; endoscopy; child.*

## 1. INTRODUCTION

Urinary tract endoscopy has a major role in the management of congenital uropathies as it offers the possibility of making an accurate diagnosis, evaluating the severity of the lesions, and making therapeutic interventions all at once. As it follows the natural urinary tract, endoscopy is recognized to be much less invasive than open surgery. In growing countries, this revolutionary procedure is not yet common practice, due to the limited equipment availability.

## 2. MATERIALS AND METHODS

We collected sixty-six patients who had urinary endoscopy, over a period of one year, from January 1st, 2019 to December 31, 2019. This study was achieved at the pediatric surgery department of the Habib Thameur hospital in Tunis, Tunisia.

We have included in our series all children who have had a bladder endoscopy in 2019. The patients were divided into 2 groups of study depending on:

- The first group where the endoscopy was meant for diagnostic purposes in 6 cases (9%).
- The second group where urinary endoscopy was therapeutic in 60 cases (91%).

We used 3 endoscopes KARL STORZ:

- A neonatal, cysto-urethrohome charr 7,5 with optical 0° and two pediatric urethroscopocystoscope, charr 11, length 14 cm

All the patients were installed in lithotomy position; the endoscope was introduced under view control. We realized an urethral exploration, a visualization of the bladder neck and verumontanum and we progressed into the bladder underflow of irrigation.

Cystoscopy led to the diagnosis of several diseases and allowed performing several interventions.

## 3. RESULTS

In our study the different etiologies were allocated as follows (Fig. 1):

- Vesico-ureteral reflux (VUR): 29 patients
- Ureteropelvic junction syndrome(UPJS) : 22 patients
- Posterior Urethral Valves (PUV): 2 patients
- Ureterocele : 4 patients
- Megaretere: 2 patients
- 7patients had other pathologies:
  - ✓ Bladder tumor
  - ✓ Urogenital sinus
  - ✓ Nutcracker syndrome
  - ✓ Stenosis of the bulbar urethra
  - ✓ Neurogenic Bladder: 2 patients
  - ✓ Postoperative Ureteral Stenosis (cohen+neurogenic bladder)

The diagnosis was established on the data of the interrogation, the functional signs, clinical examination and different explorations.

The median age of patients was three years, ranging from three months to fifteen years. Our series includes thirty-nine boys (59.1%) and twenty-seven girls (40.9%). Antenatal diagnosis of a malformation uropathy was done for 20 patients. As for patients who had no prenatal diagnosis, clinical symptoms varied with a predominance of urinary tract infection (39 cases) and dysuria (4 cases). Only two patients had kidney failure.

### 3.1 Diagnostic Endoscopy

- The urinary endoscopy can substantially contribute to the etiological diagnosis of

hematuria. In our series, cystoscopy was performed in two cases .the first case was nutcracker syndrome. The patient was sent to cardiovascular surgery where he underwent surgery. For the second patient, exploration objectified a urethral stricture easily overcome by the endoscope. The suites were simple with the disappearance of hematuria.

- Cystoscopy has also a major contribution to the diagnosis of tumoral pathology. In our series, only one case of malignant bladder tumor was identified. Endoscopy was diagnostic and allowed to sample biopsies. Pathological examination revealed an embryonal rhabdomyosarcoma.

-As part of the exploration of the urogenital sinus and Mullerian anomalies, urinary endoscopy is very helpful. In our series, cystoscopy was performed in one patient and confirmed the diagnosis of urogenital sinus showing a short common channel and two bladder and vaginal orifices.

- The exploration denied the presence of valves in two cases and showed a bladder with columns and cells, pointing to the diagnosis of neurological bladder with sphincter hypertonia.

### 3.2 Therapeutic Endoscopy

In our study, Urethrocystoscopy enabled a non-invasive treatment of many pathologies.

#### 3.2.1 Deflux injection

Our series includes 29 patients with VUR of several grades, with a predominance of grades II and III. Eight patients had VUR associated with the neurogenic bladder. Endoscopic treatment has been proposed for all patients with VUR, whatever the grade and the associated anomalies. Deflux was our reference biomaterial. In fact it is the only product available in Tunisia so far. Regarding the injection technique, both methods (STING and HIT) were used with a predominance of STING (66%).The average volume injected was 0.77 ml, with a range of 0.2 to 1.6 ml. The largest quantities were injected for high-grade reflux.

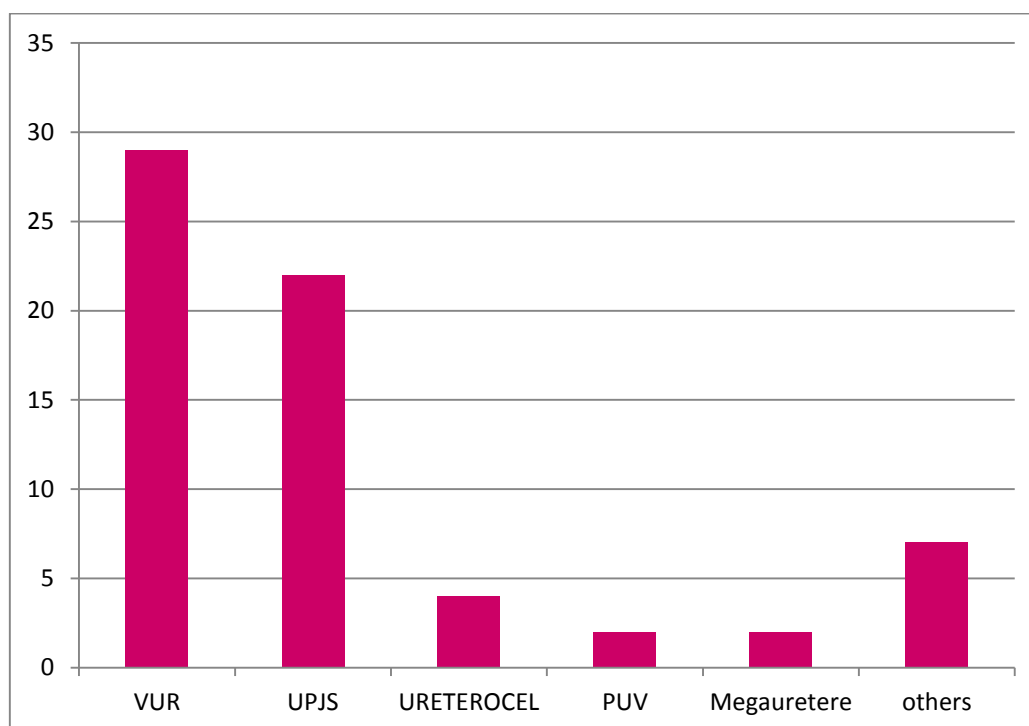


Fig. 1. Distribution of patients by pathology

Table 1. Results after one injection

VUR	Disappearance	Increased	Unchanged
36	24	3	9

### 3.2.2 Management of posterior urethral valves

In our study, the established protocol was vesicostomy first, followed by an endoscopic section of the valves in one case. The second patient had consulted at a late age (1 year). Once the diagnosis was confirmed, the endoscopic section was performed. The instrument used was the electric resector for both patients. No postoperative draining gesture was made and no complications were noted. The immediate evolution was marked by the stabilization of the relative renal function in one case and the persistence of renal failure in the second case.

### 3.2.3 Ureterocele section

This surgery was performed for 4 patients. In two cases the ureterocele was on duplicity associated with VUR on Hemi's lower kidney. Three patients had orthotopic ureterocele which

has been cut according to the technique of Rodriguez. Endoscopic section was impossible to achieve for the fourth patient, because of ectopic ureterocele. The therapeutic decision was to make a section of the ureterocele with reimplantation according to Lead Better Politano (Fig. 2-3).

### 3.2.4 Removal of double J stent

In our work Twenty-two patients had a ureteropelvic junction syndrome, they all had a pyeloplasty by Anderson Hynes, and the establishment of a JJ stent was part of the surgical procedure. Eighteen patients underwent extraction of the JJ stent using cystoscopy without incident. For others, we opted for the surgery due to complications: migration in 3 cases and gallstones in one case (Fig. 4). The removal of the JJ stent was made within an average of three months for all our patients.

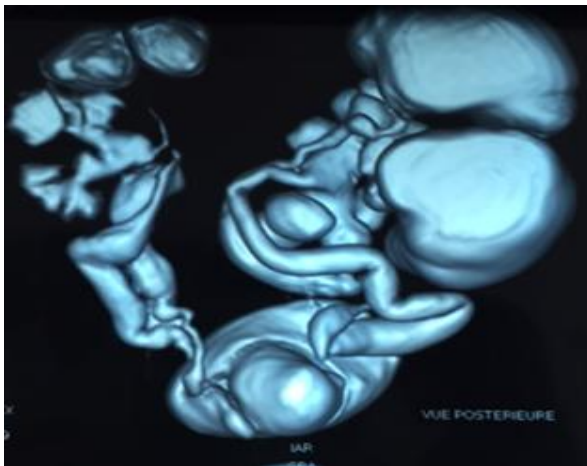


Fig. 2. Bilateral ureterocele

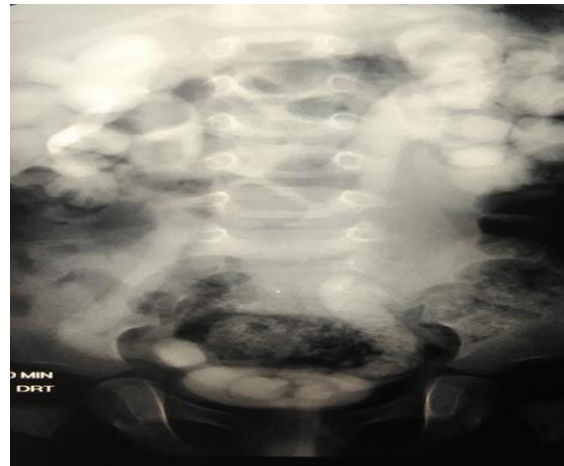


Fig. 3. Ureterocele on pyeloteral duplicity



Fig. 4. Gallstones on double j stent

### 3.2.5 Pose of double J stent

In our series, two patients had obstructive megaureter. For the first one, the pose of the JJ stent was an emergency, due to kidney failure and a major urinary tract dilatation. For the second patient, the indication of the JJ stent was to delay the final treatment before the age of one year and a relatively compromised renal function. This simple gesture has allowed us to avoid the deterioration of renal function.

## 4. DISCUSSION

Cystoscopy is an extremely reliable tool of exploration of the natural conduits; it has multiple indications.

### 4.1 Diagnostic Endoscopy

It is intended for labeling the cause of hematuria and it is a reference in the detection of bladder tumors [1]. It is also a valuable tool for assessing urinary obstruction and certain birth defects, such as sexual ambiguities and anomalies of the cloaca. Thanks to this technique; we can inspect macroscopically the organs of the lower urinary tract and observe directly the mucosa.

Urethrocystoscopy is part of the diagnostic strategy of haematuria especially when the contribution of imaging is insufficient [2,3]. It helps to establish the topographic diagnosis when the lesion is low [1]. For the original high haematuria, exploration is based on ureteroscopy seeking small ureteral tumors or hemangiomas. In this work, cystoscopy was performed in two cases as part of the exploration of a hematuria. It was a nutcracker syndrome, in one case. This patient was referred for cardiovascular surgery or had surgery. For the second patient, the exploration objectified a urethral narrowing easily passable by the endoscope. The sequels were simple with disappearance of hematuria

Urinary endoscopy allows the visualization of bladder tumor, its precise characteristics and enables the operator to sample biopsies from the tumor and from all suspicious areas of the mucosa, which will provide a positive diagnosis after histopathological examination [1]. It also provides monitoring after treatment of a bladder tumor and early screening of the recurrences. Bladder tumors are exceptionally observed among children and radiology alone is not sufficient to make the positive diagnosis where

from the importance of cystoscopy essentially in the diagnostic of rhabdomyosarcoma which represents about 5% of all solid tumors among children [4,5]. In our series, only one case of malignant bladder tumour was identified. Endoscopy was diagnosed and allowed biopsies to be performed. Anatomopathological examination revealed an embryonic rhabdomyosarcoma.

Endoscopy facilitates the topographic location of the various cavities in urogenital sinus and Mullerian anomalies. It can also evaluate the length of the urethra and of the common channel [6]. In the case of hydrocolloids, the endoscopic section of the lower portion of the vaginal septum can be performed to void the retention. In our work, cystoscopy was performed in a single patient, and confirmed the diagnosis of urogenital sinus by showing a short common canal then two vaginal and bladder orifices.

In case of abnormal implantation of the ureters, urinary cystoscopy complements the imaging by showing an ectopic meatus, or an eccentric meatus, which can be situated below the bladder neck in girls and at the posterior urethra in boys [1].

Cystoscopy shows also the headquarters of the urethral stenosis and appreciates its length and characteristics and allows confirmation of the posterior urethral valves diagnosis and urethral diverticulum.

### 4.2 Therapeutic Endoscopy

Although the benefits of endoscopy in the treatment of vesicoureteral reflux are well established, the choice of the material remains a source of considerable discussion.

Deflux is the most used agent in the endoscopic treatment of reflux giving so far the best results. Other products were studied such as polyolpolyacrylate, better known as "Vantris", which is a non-absorbable biomaterial, resistant to migration [7].

Several recent studies have shown that the injections of Vantris are simple and effective. Stanislav Kocherov and al carried out a multicentric study of 611 patients between 2009 and 2013. The cure rate after a single injection of Vantris was 94% all grades and almost 99% for grades III [8].

Farzaneh Sharifiaghdas et al have compared it to Deflux, and concluded that both agents had the same cure rate and few postoperative complications. Moreover, the Vantris is much cheaper and more durable making this product an interesting alternative to Deflux [9,10].

Endoscopic treatment using DEFLUX is increasing, thus achieving an adequate alternative to the long-term antibiotic prophylaxis and surpassing the surgical reimplantation. In the series of Garcia and al, endoscopic treatment using Deflux injection is as effective as conventional surgery [11].

**Table 2. Comparison of results between surgical and endoscopic treatment; Series Garcia and al**

	<b>Number of patients</b>	<b>Success rate</b>
Surgery	32	100%
Endoscopy	35	91%

The majority of series recommend the use of DEFLUX as first-line therapy for vesicoureteral reflux of Low grade 2 and 3. The success rates are around 85% after a single injection and over 90% after the second injection [12,13].

Jason P. Van Batavia et al recommend the use of DEFLUX when the reflux is associated with bladder dysfunction. The success rate is 50% after a first injection of all ranks [14]. This rate can be improved up to the figures for a primitive reflux, after two to three injections [14,15]. Therefore Deflux is still a reasonable therapeutic tool in the treatment. of VUR associated with bladder anomalies where open surgery is a contraindication.

Endoscopic treatment has also proved its effectiveness in the treatment of persistent reflux after ureterovesical reimplantation. The success rate was 77% after first injection and could reach 84% after a second injection [16].

Moreover, we were able to evaluate in our series the cost of the injection of one ampoule of Deflux compared to surgery. It proves to be lower than the surgical reimplantation despite the high prices of the biomaterials.

The endoscopic treatment has several other advantages, above all the reproducibility,

allowing multiple injections, and the ability to surgically reoperate by more conventional means.

Our series consists of 29 patients with vesicular reflux of different grades with predominance of grades II and III. Eight patients had an VUR associated with a neurological bladder.

Endoscopic treatment has been proposed for all patients with VUR, regardless of grade and associated abnormalities (neurological bladder).

For patients with a neurological bladder of 13 ureteral units, the results were as follows: VUR disappeared for 8 ureters and persisted in 2 ureters. For the rest, the result of the cystographic control is not yet available.

Deflux has been our reference biomaterial. It's actually the only product available in Tunisia so far. As a result, all our reflux patients have been treated by the Deflux. Another product, the DEXELL will soon be on the market in Tunisia, a prospective study on its effectiveness is to be considered. During our study, the Deflux was not covered by health insurance and those parents who bought it.

Our results do not match those of the literature. Indeed the success rates of our series do not exceed 66.7%. We have a decrease in the grade of RVU in 8.3% of cases, and a persistence of the same grade in 25% of cases. Although this treatment is reproducible, the socio-economic conditions of our patients did not allow it, only two patients received a second injection. However the endoscopic injection was considered as the first choice therapy, in our service, because of its minimally invasive character

- A. Posterioruretral valve is the most common cause of sub vesical obstruction in a child. Its upstream and downstream consequences are often severe and precocious. It also represents the leading cause of kidney failure among boys with important impact on the bladder.

Prenatal treatment modalities are now proposed, with the development of extremely miniaturized equipment allowing a fetal cystoscopy.

In growing countries, most of these boys consult postnatal. The clinical presentation is often atypical, varied and misleading. It combines

dysuria, urinary tract infection and kidney failure in different degrees.

Since the introduction of cystoscopy, the endoscopic section of the valves of the posterior urethra has become a simple procedure with a minimal rate of complications; 5 to 25% depending on the series. These complications are mainly represented by urethral stricture and urinary incontinence.

Yet, this treatment requires appropriate endoscopic equipment and experience in pediatric urinary endoscopy [17]. A nephrological monitoring is necessary to remedy the ureterovesical and renal sequelae caused by the initial obstruction.

Abdulrasheed A. Nasir and al recommend a primary vesicostomy. This initial drainage reduces hydronephrosis, improves kidney function, helps balance the hydroelectrolytic problems and controls a possible urinary tract infection [18,19].

In fact, the urinary drainage can be an alternative at a very early age; or in case of complications; or respiratory distress secondary to pulmonary hypoplasia associated with severe kidney failure.

Endoscopic section of the valves remains the definitive treatment, thereby removing urethral obstruction under visual control [19].

For our patients, the established protocol was a vesicostomy first followed by an endoscopic section of the valves in one case.

The second patient had been seen at a late age (1 year). Once the diagnosis was confirmed, a first line endoscopic section was performed.

If for some teams this protocol is a choice, for us the age of resection was dependent on the availability of material and the lack of suitable equipment

B. The management of the ureterocele has long been a subject of controversy. There is no real consensus for its management. Several therapeutic options may be adopted, depending on the type of ureterocele and the quality of the renal parenchyma. The ultimate goal is the preservation of renal function, prevention of complications and the treatment of associated reflux [20]. These included

therapeutic endoscopic section of the ureterocele as well as open surgery [21, 22, 23].

In our series, four patients had ureterocele. In two cases, the ureterocele was associated with a complicated duplicity of an RVU on the lower hemi- kidney, the other two were on simplex system. Three of our patients had an endoscopic section using Rodriguez's technique. For the last patient who had an ectopic ureterocele, the therapeutic decision was to make a section with a re-implantation according to Lead Better Politano.

C. Double J stent: Even though the natural evolution of the mega ureter may be towards spontaneous recovery in many cases, surgical treatment may be needed sometimes. Actually, the surgical treatment will be indicated when the obstruction remains patent, with compromised renal function, or if it is a bilateral megaureter or a solitary kidney, undergoing repeated urinary infection with kidney scars on DMSA. The association with other uropathies especially VUR of high grade is also an indication for intervention. Currently new processes appear promising and are propounded by some teams [24]. SHENOY and Rance in 1999 [25] reported the first publication that uses the J stent in the treatment of obstructive mega ureter. The endoscopic treatment of megaureter offers an interesting alternative in specific cases. It can in fact delay, or avoid conventional surgery in early infancy [26].

- Currently, the endoscopic treatment of megaureter with balloon dilation is considered a definitive treatment that is safer and less invasive [27]. García-Aparicio et al presented a series of 13 patients treated with a rate of 84.6% success rate [27].

In another series, the same author García-Aparicio compares the high-pressure balloon dilation in the ureter reimplantation with modeling [28]. His results show that balloon dilation is as effective as conventional surgery.

## 5. CONCLUSION

Major advances in endoscopic technology have helped develop increasingly sophisticated tools

to minimize the aesthetic and traumatic impact of open surgery.

The indications for this technique are expanding gradually as emerges more efficient equipment, allowing a better outcome. However, the major limiting factor of this innovative technique is the cost in terms of initial investment and maintenance.

This method is actually living an absolute expansion becoming the first choice in the treatment of various urinary pathologies.

This growing process should be encouraged and developed, pending the availability of cheaper equipment.

## CONSENT

As per international standard or university standard, patients' written consent has been collected and preserved by the authors.

## ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the authors.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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