Medical & Surgical Urology
ISSN: 2168-9857

Bouthour et al., Med Surg Urol 2016, 5:4
DOI: 10.4172/2168-9857.1000172

Case Report Open Access

Surgical Treatment of Urolithiasis in Children: Experience of a Pediatric Surgery Department in Tunisia

Habib Bouthour*, Fatma Trabelsi, Samer Bustame, Asma Jabloun and Nejib Kaabar

Department of Pediatric Surgery and Pathology, Hopital Habib Thameur, Tunisia

Abstract

Urolithiasis is uncommon in children. This is a recurrent disease with severe evolution, which can lead to chronic renal failure. The management is multidisciplinary. Despite the innovation of new minimally invasive techniques, conventional surgery in our country remains the reference treatment. We bring our experience in the diagnostic and therapeutic management.

Keywords: Urolithiasis; Children; Endoscopy; Surgery

Introduction

The discovery of Urolithiasis in children requires a systematic and thorough etiological investigation in search of a metabolic disease, hereditary anomaly or associated Uropathy. Besides the medical care, urologic care is essential. It primarily uses extracorporeal shock wave lithotripsy (ESWL). The published data confirm that ESWL is the first-line treatment in children because of its effectiveness and safety. In case of failure or complex Urolithiasis, percutaneous Nephrolithotomy (PCNL) and Ureteroscopy (URS) are indicated. The open surgery remains an effective option but it is now rarely indicated. In our context, it retains interesting because of the non-availability of others techniques for children (suitable hardware problem, general anesthesia).

Patients and Methods

We have collected in these review 45 patients followed at the pediatric surgery department of Habib Thameur hospital for Urolithiasis over a period of 18 years from January 1996 to December 2014.

Results

The average age of our patients was six years and ten months with extreme ranging from two months to 13 years old. Our series included 29 boys and 16 girls with a sex ratio of 1.8. Different lithiasic risk factors were found: a metabolic abnormality, a malformation Uropathy, recurrent urinary tract infections, spinal trauma and neurological disease and a foreign object (Table 1). Family history of stones was found in our series in 7 cases and consanguinity in 6 cases.

The most frequent fact of discovery of Urolithiasis in our series was the urinary tract infection (20 cases). Other circumstances have been found summarized in Table 2.

Physical examination should be thorough and complete. In our study, a weight delay was noted in 11 cases, short stature in 9 cases, a lumbar contact in 8 cases, fever in 2 cases, hematuria in a case, pyuria in a case, a distended bladder in a case, hypertension in a case while the examination was normal in 33 cases (73%).

Biology has revealed an inflammatory syndrome in 6 patients and kidney failure in 9 patients. The urine culture was positive in 8 cases (Proteus mirabilis in 5 cases and Escherichia coli in 3 cases). The metabolic evaluation, practiced for 12 patients, found hyper oxaluria in 7 cases including one case associated with hypocalciuria, cystinuria in 2 cases, hyperuricosuria with hyperphosphaturia in a case, xantinuria in a case while the checkup was normal in a case.

The crystalluria showed the presence of crystals of Whewellite in 2 cases Weddellite in 2 cases Whewellite and Weddellite and in a case, cystine in 2 cases, struvite in 2 cases, uric acid in a case, 2.8 dihydroxyadenine in a case while crystalluria was negative in a case.

In our series, we had done a Kidney-Ureter-Bladder (KUB) film in 40 patients. The stones were radio-opaque in 37 cases (Figure 1).

Ultrasound was performed in 44 children and was contributive in 95% cases. The stones were unique in 22 cases (Figure 2) and multiple in 20 cases. They were renal in 29 cases, ureteral in 12 cases and vesical in 8 cases. Lithiasis was obstructive with upstream dilatation in 32 cases and not obstructive in 10 cases. It was isolated in 39 cases and associated with Nephrocalcinosis in 3 cases. Ultrasound identified 4 Coralliform Lithiasis. It also helped to detect abnormalities of the urinary tract as unilateral pelvicalyceal obstruction in 2 cases, unilateral

Risk Factors	Percentage
Metabolic Abnormality	14%
Malformation Uropathy	11%
Recurrent urinary tract infections	9%
Neurological Disease	2%
Foreign object	2%

Table 1: Risk factors of Urolithiasis in children.

Circumstance of Discovery	Number of Cases
Hematuria	9
Pain	6
Urinary Frequency	1
Oliguria	1
Urinary Retention	1
Spontaneous Stone Passage	1
Exploration of Renal Failure	4
Fortuitous	4

Table 2: Circumstances of discovery of Urolithiasis other than infection.

***Corresponding author:** Habib Bouthour, Department of Pediatric Surgery and Pathology, Hopital Habib Thameur, Tunisia, Tel: +21698588786; Fax: +21671135000; E-mail: habib.bouthour@gmail.com

Received November 01, 2016; **Accepted** November 25, 2016; **Published** December 02, 2016

Citation: Bouthour H, Trabelsi F, Bustame S, Jabloun A, Kaabar N (2016) Surgical Treatment of Urolithiasis in Children: Experience of a Pediatric Surgery Department in Tunisia. Med Surg Urol 5: 172. doi: 10.4172/2168-9857.1000172

Figure 1: KUB-renal lithiasis.

Figure 2: Ultrasound-bladder lithiasis.

Ureteropelvic duplicity in a case and Ureteropelvic dilatation in 2 cases. The intravenous urography (IVU) was realized in 30 patients and was contributive in 97% of cases. The computed tomography (CT) was performed in our series in 4 cases. His contribution was 100% (Figure 3). A kidney rotation has been detected in a patient.

Surgical treatment was indicated for all children in our series but indications were different: 21 children had obstructive lithiasis, 9 had coralliform stones, and both had an Ureteropelvic junction obstruction associated with stones, both had escaped to medical treatment, ten had bladder stones and one child had urethral calculi (Table 3). Kidney stones (22 cases) were treated by a Posterolateral Lumbotomy which was associated with a pyelotomie (18 cases) or a nephrotomy (4 cases) (Figure 4).

The kidney stone was unique in 16 cases and multiple in 6 cases. Its size varied between a few millimeters and two centimeters. Renal Lithiasis was associated with an abnormality of the urinary tract in three cases:

* Ureteral duplicity in 1 case

* Ureteropelvic junction obstruction in 2 cases.

Pyuria was observed in 4 cases. Pyonephrosis was found in 1 case. The lithiasis was associated with a superior polar collection in 1 case.

Extraction of kidney stones was complete in 16 cases (73%) when the stone was unique and incomplete in 6 cases (27%). Nephrectomy was performed in the case of pyonephrosis because the kidney is known to be non-functional in preoperatively. For the drainage, a Redon drain was put in place in all cases. Urinary drainage was performed in 11 patients (Table 4).

Ureteral stones (6 cases) were treated by a posterolateral lumbotomy in 3 cases, a Pfannenstiel incision in one case and a horizontal iliac incision in two cases. All stones were extracted by ureterotomy (Figure 5). Stones were extracted in all cases. Ureteral wash was associated in 1 case.

Three children had drainage for their ureteral lithiasis. It was realized by bilateral nephrostomy in one case, a nephrostomy with a Foley catheter in one case and ureteral catheter with Foley catheter in one case. For bladder stones (8 cases), 4 were removed endoscopically

Figure 3: Computed tomography showing a renal lithiasis.

Surgical Indications	Number of Patients
Obstructive Lithiasis	21
Coralliform	9
Ureteropelvic Junction Obstruction Associated with Stones	2
Failure of Medical Treatment	2
Bladder Stone	2
Urethral Stone	1

Table 3: Surgical Indications.

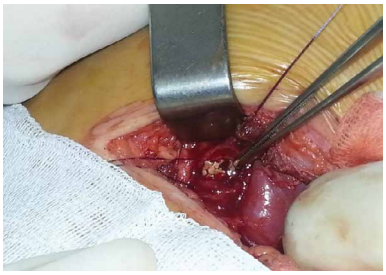

Figure 4: Intraoperative view of renal urolithiasis.

Drainage Equipment	Number of Patients
Double J Stent	3
Foley Catheter	2
Nephrostomy	2
Nephrostomy+Foley Catheter	2
Pyelostomy+Foley Catheter	1

Table 4: Drainage equipment after renal stone extraction.

Figure 5: Intraoperative view of ureteral lithiasis.

and 4 by a Pfannenstiel incision with bladder size. For uretral stone, it was removed by meatotomy. The lithiasic associations were found in 4 cases (renal and ureteral, urethral and bladder).

Our series include four particular observations

There were two children aged seven months and seven years, respectively, who had pre-terminal renal insufficiency and had obstructive kidney stones. The surgical procedure consisted in a nephrostomy without extraction of the stones. The evolution was marked by the improvement of the renal function. The children had subsequently a surgical extraction of the lithiasis.

The third observation is about a 9-year-old girl who was admitted for a urinary lithiasis discovered following a urinary tract infection. At the KUB film, the stone was in the bladder. We had completed with ultrasound and IVU which showed that the stone was enclosed in the right uretero-bladder junction with upstream ureteral dilation. We then carried out an endoscopy which allowed the extraction of the stone.

The fourth observation is that of a 19-month-old child attending in the Pediatric Department for adenine phosphoribosyltransferase (APRT) deficiency in pre-terminal renal failure with bilateral obstructive ureteral lithiasis. The patient had an ascent of bilateral double J catheter by endoscopy as a waiting treatment. The evolution was marked by the spontaneous expulsion of the stone after one week and the child subsequently had the ablation of the ureteral catheters.

Postoperative complications were marked by a urinary tract infection in 8 cases, kidney function distortion in 4 cases, urinoma in 2 cases and ureteral stenosis in a case. The residual stone was noted in 11 patients and recidivism in 7 children.

Discussion

The stone disease in children is less common than in adults. In Tunisia, since the late 60s and over 80s, the incidence was higher than 30 cases per year [1]. This impact has been a significant decrease and currently represents 0.4 cases/1000 pediatric admissions/year [2]. The stone disease in children affects all ages. In our series, the average age was 6.8 years and the sex ratio was 1.8. Metabolic disorders may be revealed in the interrogation. Pathologies such as primary hyperoxaluria or cystinuria are known to producing urolithiasis in children. Urinary tract infections may also constitute lithiasic risk factors.

The association of stones to a malformation uropathy in the literature varies between 9 and 34% [3]. The interrogation should also search spinal injury, foreign object in the bladder, indwelling catheter and bladder augmentation that can cause bladder stones formation. Urinary tract infection is the most frequent circumstance of discovery finding in children.

The clinical expression is still severe and it is a medical and surgical emergency. Others circumstances of discovery can be found such as hematuria, back pain, urinary disorders, kidney failure, spontaneous stone passage or accidentally.

Physical examination must be thorough and complete

The biological checkup includes the research of an inflammatory syndrome and the evaluation of renal function. The urine culture is necessary because the infection can be the cause or consequence of the stones. The study of crystalluria allows the search for metabolic abnormalities.

Radiological exploration of urolithiasis usually starts with making a Kidney-Ureter-Bladder (KUB) film. However, it has many limits. The stone cannot be seen because it is too small, radio transparent, masked by digestive gases or faecal stasis or in projection on bony prominences [4]. Ultrasound has the advantages of being easily available, non-invasive and avoiding radiation. The stone appears as a hyper echogenic image with posterior acoustic shadowing. Ultrasound can detect small stones (2-3 mm) and has significant interest in the detection of radio transparent lithiasis [4].

According to the European Association of Urology [5], ultrasound is the first radiological examination required in pediatric urolithiasis. The intravenous urogram is analyzed regarding renal function, dilatation of renal pelvi-calyceal system and ureter, location and area of the renal stone and radiological opacity. Non-opaque stones are noticed as contrast medium filling defects. Intravenous urography is contraindicated in acute ureteral stone colic, renal failure (creatinine ≥ 200 µmol/L), myeloma and similar diseases, contrast medium allergy, untreated hyperthyroidism [4].

Non-contrast enhanced computed tomography (NCCT) is regarded as the gold standard due to the high sensitivity and specifity [6]. The treatment objective is the elimination of stones. Medical treatment is also designed to prevent the formation of new stones by diluting urine and correcting metabolic disorders which cause stone formation [7]. For patients requiring surgical treatment, several techniques are available. ESWL is increasingly used and has become the therapeutic option in the treatment of the majority of pediatric urolithiasis [7]. It is a minimally invasive technique that does not require a long hospital stay and that is associated with a low complication rate [8]. The need for general anesthesia during ESWL depends on the patient's age and the lithotripter used [9].

Some authors still have concerns about the potential biological effects of ESWL on immature kidneys and surrounding organs in children. But according to the European Association of Urology [10], no study has demonstrated irreversible functional or morphological side effects during or long-wave lithotripsy. The efficiency of ESWL in children was demonstrated by the different series published [11-13]. It can be explained by:

* The small size of the child that helps reducing energy loss of the shock wave before attaining the stone.

* The compliance of the urinary tract of the child promoting the elimination of even large fragments [14].

According to the European Association of Urology [10], the indications for ESWL In children are similar to those in adults; however, they pass fragments more easily. Children with renal stones of a diameter up to 20 mm are ideal candidates for ESWL. Otherwise, this technique has some complications such as: hematuria, skin irritation, hemoptysis, small thermal lag and lesion of the renal parenchyma [7]. Another technique can be used that is the percutaneous nephrolithotomy (PCNL). Its principle is the percutaneous insertion of an endoscope to the renal pelvis caliceal cavities to extract the stones and to fragment them if necessary [15]. It is performed under general anesthesia and under radiological control.

This technique involves five steps:

* The rise of ureteral catheter

* The puncture of cavities

* The establishment of the tunnel

* The intracorporeal lithotripsy and stone extraction

* The drainage (nephrostomy associated with ureteral drainage) [16].

According to the European Association of Urology, the indications for PCNL for paediatric patients are similar to those in adults. In children, PCNL is recommended for treatment of renal pelvic or caliceal stones with a diameter>20 mm [10]. Nevertheless, PCNL has some complications such as: hemorrhagia, urinary infection, disinsertion of pelvic junction, wound of a neighboring organ, hypothermia and renal failure [10]. Ureteroscopy has become an efficacious treatment for paediatric upper urinary tract stones. It might be particularly effective for treatment of proximal ureteral calculi and for stones<1.5 cm in the lower pole calices [17].

Stones are removed intact with Dormia basket or fragmented by ballistic lithotripsy or vaporized by Holmium laser YAG [18]. The urethrocystoscopy is performed under general or spinal anesthesia. The bladder is half-filled with physiological serum at a level enabling expansion without triggering walls of a bladder reflex [19]. The need for fragmentation of stones is discussed.

Ureteroscopy and urethrocystoscopy have some complications such as: perforation of the ureter or urethra, ureteral disinsertion, hemorrhagia, infection, ureteral stenosis and vesicoureteral reflux [20-22]. The treatment of urolithiasis in children with open surgery is now rare in developed countries but is a common practice in our country. The surgical technique differs according to the location of the stone. For kidney lithiasis, the lumbotomy is the preferred way to treat these stones. It provides good exposure of the kidney. The posterior approach can also be used especially in small children [23]. To remove stones, pyelotomy is the least invasive way.

Nephrotomy is a complementary technique to the extended pyelotomy and should be used only as a last resort [23]. The lumbar ureter is generally tackled by Extraperitoneal lumbotomy. It has the advantage of not cutting muscles or nerves and not be very painful. Its morbidity is lower [23]. The iliac ureter is approached through a Mac Burney incision. The pelvic ureter may be approached by an oblique lateral anterior incision or through Pfannenstiel incision. After exposure of the ureter, the stone is immobilized between two lakes to prevent its involuntary migration. The ureter is incised longitudinally. Stone is extracted using an atraumatic grasper [23].

For bladder stones, the principle of the surgery is the removal of one-piece stone by opening the bladder. The procedure is performed under general anesthesia. The incision is Suprapubic arciform. The bladder is opened and can be fully explored. All stones are removed. A urinary catheter is put in place [19]. For urethral stone, the treatment depends on the location. The stone of the posterior urethra must be pushed through backward into the bladder. Its treatment joins that of bladder stone [20]. The stone of the penile or bulbar urethra can be moved distally by increasing urinary pressure and by using lubricants to the distal portion of the urethra. In case of failure of these maneuvers, Urethrotomy is needed [24].

Indications for surgery include

Failure of primary therapy for stone removal; very young children with complex stones; congenital obstruction that requires simultaneous surgical correction; severe Orthopaedic deformities that limit positioning for endoscopic procedures; and abnormal kidney position [10]. Open surgery has several complications such as: sepsis, infection of the surgical wound, hematoma, urinary peritonitis, kidney fracture, transient acute tubular necrosis if Nephrotomy, vascular lesions in the kidney, ureteral obstruction and hypertension [23]. The laparoscopic approach is not easy and requires a good expertise, particularly in laparoscopic suturing. This explains the limited number of series published in this issue [24]. The indications for this technique are those of conventional surgery.

Conclusion

Currently, the first-line treatment of Urolithiasis in children is the ESWL. The use of conventional surgery should be reserved for cases where a minimally invasive treatment would be impossible. To achieve this aim, a more enhanced multidisciplinary collaboration is needed.

References

1. Duclos JM (2004) Editor Néphrectomies difficiles. Annales d'urologie Elsevier.
2. Alaya A, Nouri A, Najjar MF (2012) Epidemiological changes of paediatric urolithiasis in Tunisia. Tunis Med 90: 518-523.
3. Abarchi H, Hachem A, Erraji M, Belkacem R, Outarahout N, et al. (2003) Pediatric vesical lithiasis. 70 case reports. Ann Urol 37: 117-119.
4. Pietrow PK, Pope JC, Adams MC, Shyr Y, Brock JW (2002) Clinical outcome of pediatric stone disease. J Urol 167: 670-673.
5. Villa L, Giusti G, Knoll T, Traxer O (2016) Imaging for Urinary Stones: Update in 2015. European Urology Focus 2: 122-129.
6. Ulusan S, Koc Z, Tokmak N (2007) Accuracy of sonography for detecting renal stone: comparison with CT. J Clin Ultrasound 35: 256-261.
7. Traxer O, Lechevallier E, Saussine C (2008) Lithiase urinaire de l'enfant. Progrès en urologie 18: 1005-1014.
8. Logarakis NF, Jewett MA, Luymes J, Honey RJ (2000) Variation in clinical outcome following shock wave lithotripsy. J Urol 163: 721-725.
9. D'Addessi A, Bongiovanni L, Racioppi M, Sacco E, Bassi P (2008) Is extracorporeal shock wave lithotripsy in pediatrics a safe procedure? J Pediatr Surg 43: 591-596.
10. Skolarikos A, Straub M, Knoll T, Sarica K, Seitz C, et al. (2015) Metabolic evaluation and recurrence prevention for urinary stone patients: EAU guidelines. Eur Urol 67: 750-763.
11. Kurien A, Symons S, Manohar T, Desai M (2009) Extracorporeal shock wave lithotripsy in children: equivalent clearance rates to adults is achieved with fewer and lower energy shock waves. BJU Int 103: 81-84.
12. Lottmann HB, Archambaud F, Traxer O, Mercier-Pageyral B, Helal B (2000) The efficacy and parenchymal consequences of extracorporeal shock wave lithotripsy in infants. BJU Int 85: 311-315.
13. Traxer O, Lottmann H, Archambaud F, Helal B, Pageyral BM (1998) La lithotritie extra-corporelle par ondes de choc chez le nourrisson. Étude de son retentissement sur le parenchyme rénal. Ref doc 32: 191-196.
14. Arifi M, Halim Y, Mel AB, Lachkar A, Aitouamar H, et al. (2006) Extracorporeal lithotripsy of upper urinary tract stones in children. Prog Urol 16: 594-597.
15. Woodside JR, Stevens GF, Stark GL, Borden TA, Ball WS (1985) Percutaneous stone removal in children. J Urol 134: 1166-1167.
16. Le Duc A, Desgrandchamps F, Cortese A, Cussenot O, Teillac P (1999) Chirurgie percutanée du rein pour lithiase. Encycl Méd Chir 1999: 1-14.
17. Smaldone MC, Corcoran AT, Docimo SG, Ost MC (2009) Endourological management of pediatric stone disease: present status. J Urol 181: 17-28.
18. Schuster TG, Russell KY, Bloom DA, Koo HP, Faerber GJ (2002) Ureteroscopy for the treatment of urolithiasis in children. J Urol 167: 1813-1813.
19. Roberts WW, Gearhart JP, Mathews RI (2004) Time to recurrent stone formation in patients with bladder or continent reservoir reconstruction: fragmentation versus intact extraction. J Urol 172: 1706-1709.
20. Knopf HJ, Graff HJ, Schulze H (2003) Perioperative antibiotic prophylaxis in ureteroscopic stone removal. Euro Urol 44: 115-118.
21. Aridogan IA, Zeren S, Bayazit Y, Soyupak B, Doran S (2005) Complications of pneumatic ureterolithotripsy in the early postoperative period. J endourol 19: 50-53.

22. Jarrar K, Boedeker R, Weidner W (1996) Calculs de struvites. Ann d'Urol 1967-2007.

23. VanDervoort K, Wiesen J, Frank R, Vento S, Crosby V, et al. (2007) Urolithiasis in pediatric patients: a single center study of incidence, clinical presentation and outcome. J Urol 177: 2300-2305.

24. Yagisawa T, Ito F, Kobayashi C, Onitsuka S, Kondo T, et al. (2001) Retroperitoneoscopic pyelolithotomy via a posterior approach for large impacted renal pelvic stone. J endourol 15: 525-528.