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Obstructive Uropathies: Epidemiological Features and Diagnostic Approaches in Dakar

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Abstract

Introduction: Obstructive uropathies refer to anatomical impediments to normal urinary flow. They are predominantly caused by congenital malformations of the urinary tract and occasionally complicated by obstructive urinary stones. This study aims to elucidate the epidemiological and diagnostic facets of obstructive uropathies. **Patients and Method:** This retrospective, descriptive study was conducted over six years, from January 1, 2018, to December 31, 2023, at the pediatric surgery department of Albert Royer Children's Hospital in Dakar, Senegal. The study focused on the frequency of obstructive uropathies, the sex ratio, discovery contexts, types and locations of uropathies, and associated malformations. **Results:** Among the 29,935 children received in the department during the study period, 130 cases of obstructive uropathies were documented, equating to a hospital incidence of 0.43%. The mean age of patients was 42.53 months, ranging from one day to 15 years. Infants constituted the largest affected group, at 47.69%. The cohort included 106 males and 24 females, rendering a sex ratio of 4.41. The antenatal diagnosis was confirmed in 27 patients (20%). Uretero-hydronephrosis emerged as the predominant clinical indication. Postnatally, urinary disorders prompted consultation in 36% of cases. Ultrasound examinations were performed universally. Additionally, VUCG was conducted in 49% of patients to identify lower urinary tract obstructions, while 39% underwent urological CT scan for upper tract obstruction etiology. Renal distress with electrolyte imbalance was evident in 8% of cases. Concurrent urogenital pathologies were present in 18% of cases. Notably, posterior urethral valves accounted for 39%, pyeloureteric junction obstruction for 31%, obstructive caliceal and pelvic lithiasis at 8%, and

obstructive ureteral lithiasis at 6%. Other obstruction causes included obstructive megaureter on simple systems (3%), ectopic ureter in duplex systems (2%), urethral stenosis (2%), obstructive urethral lithiasis (2%), obstructive bladder lithiasis (2%), obstructive megaureter in duplex systems (1%), ureterocele in duplex systems (1%), ureteral stenosis (1%), and ureterocele with obstructive bladder lithiasis (1%). **Conclusion:** Predominantly malformative in origin, obstructive uropathies necessitate ultrasound of the urinary tract as a primary diagnostic tool. Their etiologies are posterior urethral valves, pyeloureteric junction obstruction, and obstructive urolithiasis.

Keywords

Obstructive Uropathies, Congenital Anomalies of Kidneys and Urinary Tract, Posterior Urethral Valves

1. Introduction

Obstructive uropathies are a group of diseases characterized by partial or total blockage of the flow of urine. Obstructions can be located at several parts within the urinary tract, extending from the kidneys to the urethra, and may be congenital or acquired, as well as either extra or intraluminal [1]. Without prompt diagnosis and management, these conditions progress toward end-stage renal disease. Recently, malformative uropathies have been more frequently identified during the prenatal stage, owing to advancements in fetal imaging technologies. Indeed, malformative uropathies represent the most prevalent causes of obstructive uropathies, with diverse etiologies [2] [3]. Congenital etiology is mainly posterior urethral valves (PUV) and ureteropelvic junction obstruction (UJPO). Although less common in pediatric populations, urolithiasis can also precipitate obstructions in urinary flow [4]-[6]. The retention of urine within the urinary tract and the disruption of normal urinary flow can lead to serious complications, including urinary tract infections, renal impairment, and urinary function abnormalities [7]. Due to diagnostic delays, these complications are frequently encountered in our clinical practice. Therefore, we conducted this study to describe the epidemiological and diagnostic features of obstructive uropathies in children as observed in our clinical practice.

2. Patients and Methods

This retrospective descriptive study was conducted over 6 years, from January 1, 2018, to December 31, 2023. It included all patients between 0 and 15 years old who were diagnosed with obstructive uropathy in the pediatric surgery department of Albert Royer Children's Hospital in Dakar. Uropathy was suspected in case of urinary symptoms or urinary tract infection (UTI) and confirmed based on imaging. Patients whom the uropathy was not obstructive were not included. Data were collected from patients' admission and hospitalization files and

encoded on a preestablished questionnaire.

The study focused on the incidence of obstructive uropathies, the epidemiological characteristics of affected children, existence of antenatal diagnosis, circumstances of postnatal discovery, the imaging diagnostic criteria mainly urinary tract ultrasound, voiding cystourethrogram (VCUG) and urological CT-scan, associated malformations, and the types and anatomical locations of the various obstructive uropathies, the associated secondary complication on the upper urinary tract. Obtained data were encoded and analyzed using Word and Excel (Microsoft 2013).

3. Results

3.1. Epidemiological Aspects

Over the six years of the study, 130 cases of obstructive uropathies were documented, accounting for 0.43% of all diagnosed pathologies during this time frame. Of these patients, 106 (82%) were male and 24 (18%) were female, determining a sex ratio of 4.41. The mean age of the patients was 42.53 months, ranging from one day to 14 years. Infants counted for 62 cases, equivalent to 47.69% of the population study. The age distribution of patients is illustrated in Figure 1.

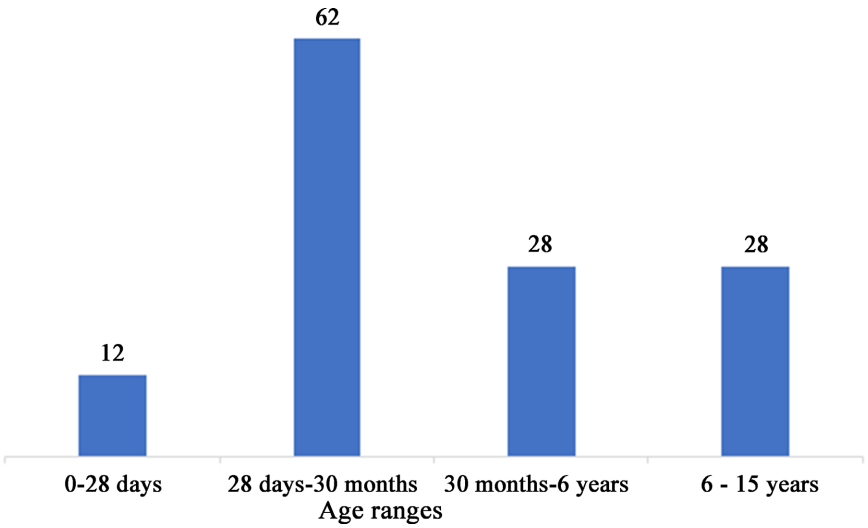

Figure 1. Age distribution.

3.2. Diagnostic Characteristics

Among a cohort of 104 patients with congenital obstructive uropathies, 27 patients, representing 27.67%, exhibited abnormal findings on antenatal obstetric ultrasound, while 77 patients, constituting 73.33%, showed no abnormality during antenatal ultrasound screening. The antenatal diagnosis was typically made at approximately 30 weeks of gestation, with 63% of cases (17 patients) diagnosed in the third trimester and the remaining 37% (10 patients) diagnosed in the second trimester. Various sonographic anomalies were identified, with uretero-hydronephrosis observed in 9 cases (34.62%), and dilation of the pyelocaliceal system

reported in 5 cases (19.24%).

In the postnatal period, the mean age at which functional symptoms occurred was 39 months, ranging from one day to 13 years. The conditions were detected under different circumstances, including urinary symptoms in 78 instances (60%), digestive symptoms in 46 instances (35.38%), and both renal insufficiency and pyelonephritis each occurring in 3 cases. The various urinary symptoms experienced by the patients are depicted in Figure 2.

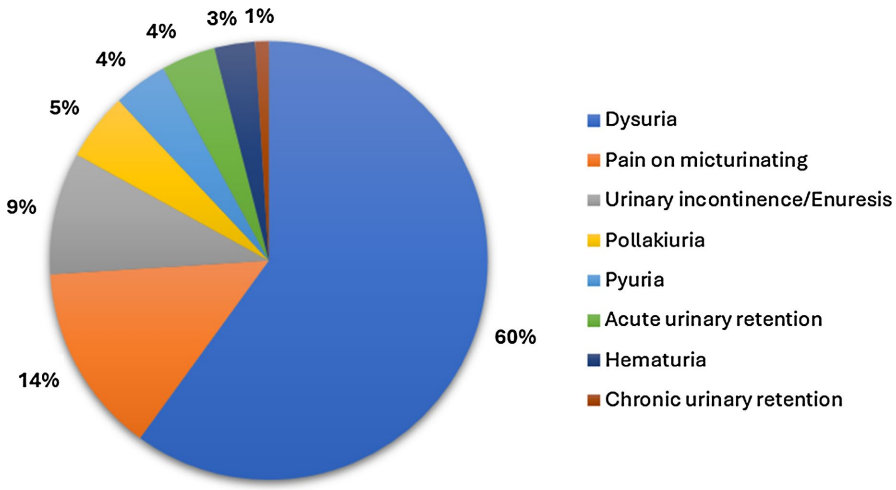

Figure 2. Distribution of urinary symptoms.

Certain patients were investigated for obstructive uropathy following an abnormal ultrasound conducted during episodes of urinary tract infection. Klebsiella pneumoniae and Escherichia coli were identified in 8 and 7 patients, respectively. Figure 3 illustrates the different pathogens identified in the urine cultures.

In 3 cases, abnormalities were identified through abdominal ultrasounds carried out as part of assessments for conditions such as polymalformative syndrome, disorders of sexual development, and anorectal malformations.

Given the suspicion of obstructive uropathy, all patients underwent urinary tract ultrasound, which was conducted as an initial diagnostic tool in 96% of cases. For those patients with a prenatal diagnosis, postnatal ultrasound was performed within a mean waiting time of 30.29 days, ranging from one day to 7 months.

Voiding cystourethrogram (VCUG) was conducted on 64 patients, accounting for 49% of the study group. In 4 cases, VCUG was the first line of investigation. The procedure confirmed the presence of posterior urethral valves (PUV) in 43 patients. Illustrated in Figure 4 is a VCUG in a patient diagnosed with PUV.

A urological CT scan was performed on 51 patients, representing 39% of the sample. These scans identified 20 cases (39%) of UPJO, with 3 cases showing an associated inferior polar artery, 10 cases of obstructive urolithiasis, 3 cases of ectopic ureter, two cases of primary obstructive megaureters, one case of ureterocele, and a single case of ureteral stenosis.

No patients underwent urological MRI procedures. Furthermore, an abdominal

plain X-ray was carried out in 12 patients (9.23%) and demonstrated urolithiasis in 8 cases. Endoscopic assessments also confirmed the presence of PUV (illustrated in Figure 5) in 49 patients.

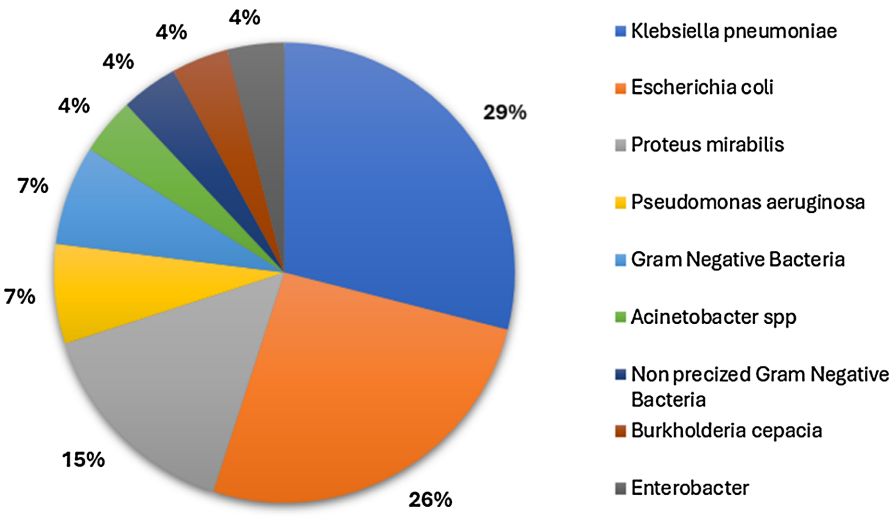

Figure 3. Distribution according to isolated bacteria.

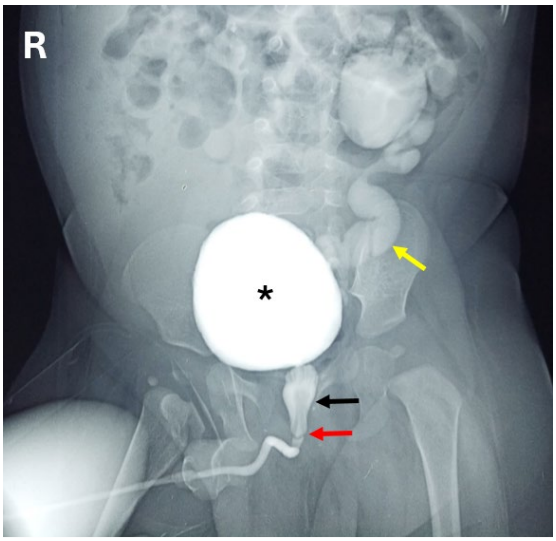

Figure 4. VUCG showing PUV. Note a normal bladder (asterisk), with high-grade left vesicoureteric reflux (yellow arrow), dilated posterior urethra (black arrow) and an image of urethral valves.

Obstructive uropathy was identified in the upper urinary tract in 71 children, constituting 54% of cases, with 19 cases made of urolithiasis, representing 26.76%. Obstructive uropathies in the lower urinary tract were noted in 59 patients, or 46%, with posterior urethral valves (PUV) accounting for 49 cases (83.07%). Bilateral urinary tract obstruction was observed in 13% of patients, while the condition was isolated to the left side in 27% of the cases. The various causes of obstructive uropathy are detailed in Table 1.

In 24 cases, obstructive uropathies were observed in conjunction with other

urogenital malformations. Table 2 lists the various associated pathologies, and Figure 6 provides an example of anomalies in the same patient.

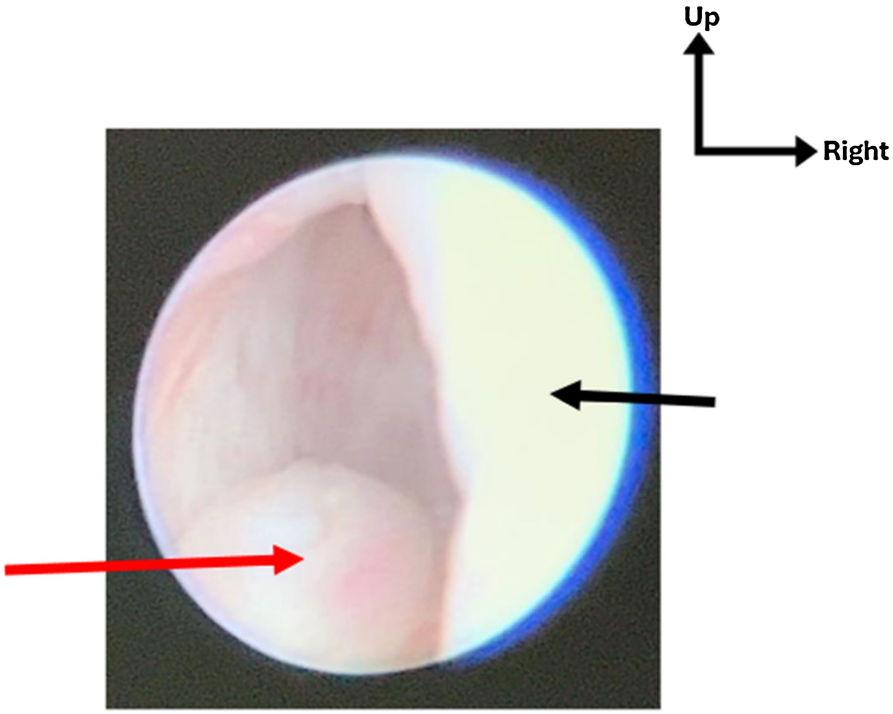

Figure 5. Endoscopic view of Young's PUV type I, showing urethral valves (black arrow) and verumontanum (red arrow) in the posterior urethra.

Table 1. Distribution by type of obstructive uropathy.

Type of uropathy	Number	Percentage
PUV	49	39
UPJO	39	31
Caliceal and pyelic lithiasis	10	8
Ureteral lithiasis	9	6
OPMU on a single system	4	3
OPMU on a double system	1	1
Ectopic ureter in duplex system	3	2
Ureterocele in duplex system	2	2
Left ureterocele and bladder lithiasis	1	1
Ureteral stenosis	1	1
Obstructive urethral lithiasis	3	2
Obstructive vesical lithiasis	3	2
Urethral stenosis	3	2

OPMU: Obstructive primitive megaureter, PUV: Posterior Urethral Valves, UPJO: ureteropelvic junction obstruction.

Table 2. Distribution according to associated urogenital pathologies.

Associated pathology	Number	Percentage
Cryptorchidism	7	39
Polycystic kidney/renal cyst	4	31
Paraureteral diverticulum	3	8
Multicystic renal dysplasia	2	6
Urachus fistula	2	3
Ectopic kidney	1	1
Horseshoe kidney	1	2
Contralateral renal agenesis	1	2
Hypospadias	2	1

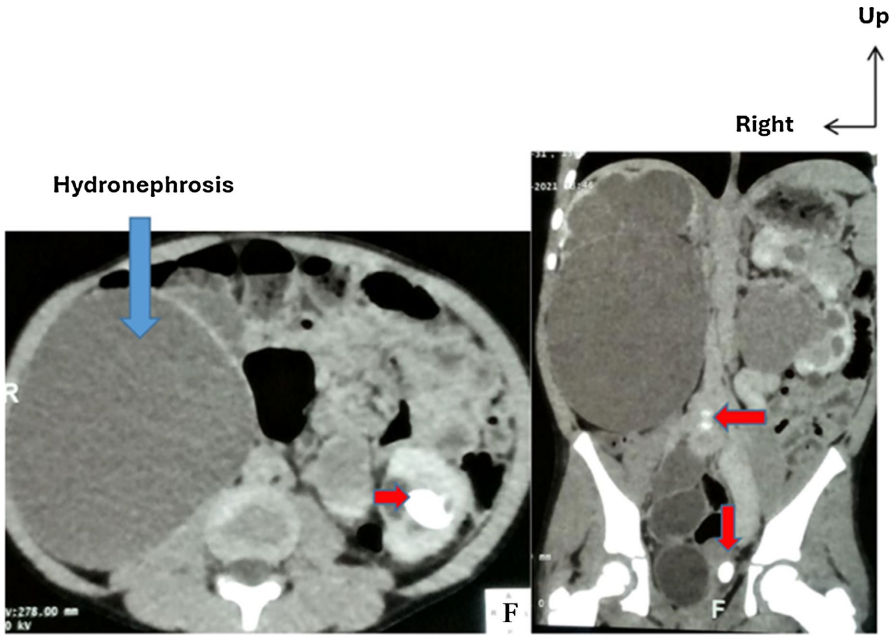

Figure 6. Calculus of the inferior calyx and left lower ureter (red arrow) associated with hydronephrosis (blue arrow) in an 8-year-old boy.

Renal scintigraphy was primarily conducted to assess the functionality of the affected kidneys, and this procedure was performed on 49 patients (37.69%).

An inflammatory syndrome was identified in 24 patients, while 32 children were diagnosed with hypochromic microcytic anemia. Uremia and creatinine levels were measured in 76 (58%) patients, with 11 exhibiting impaired renal function. Blood electrolyte anomalies were detected in 11 patients (8.46%).

4. Discussion

We have documented 130 cases of obstructive uropathies, representing an average of 22 cases per year, with an in-hospital frequency of 0.43%. Uropathies are frequently encountered in pediatric surgery consultations. Nevertheless, obstructive

uropathies are typically less common as shown in a Cameroonian study [3]. These conditions predominantly affect boys across all reported series [2] [3]. This is attributed to male-specific conditions such as PUV. Additionally, there is a notable predominance of cases in infants. Congenital anomalies of the kidneys and urinary tract (CAKUT) are the leading cause of obstructive uropathies, and those not detected during prenatal diagnosis often present as urinary infections between the ages of 1 and 24 months.

Prenatal ultrasound screening is highly effective in screening CAKUT, especially those that are obstructive [8]. However, it is not able to precisely highlight the obstruction site and does not always differentiate between upper and lower urinary tract issues. The exact mechanism causing the dilation is often unclear. In our study, only 27.67% of diagnoses were suspected prenatally; this rate remains low in Sub-Saharan Africa [3], in contrast to European countries [9].

The diagnosis delay and the prolonged symptom duration can be attributed to the clinical variability of diseases. Additionally, the occurrence of some complications postpones the conducting of some imaging tests required for etiological diagnosis. This situation is particularly applicable to VUCG, where repeated urinary tract infections frequently cause delays. In these infections, Escherichia coli is the most commonly encountered pathogen [10].

Ultrasound examination of the urinary tract is crucial for investigating the urinary system, being the most straightforward and accessible technique even in a resource-limited context, that provides a detailed morphological evaluation of the kidneys and lower urinary tract. In our study, it was used in all our patients. Furthermore, when there is an antenatal diagnosis of obstructive CAKUT, a postnatal examination is necessary by the end of the first week to accurately diagnose malformations and obstructions, excepted for suspected PUV where postnatal urinary ultrasound screening is urgent [11] [12].

The VUCG is a supplementary examination used for the morphological and functional assessment of the urethra and bladder. Its execution requires prior confirmation of the absence of urinary tract infection, and it should not be conducted as a first-line approach. Instead, it remains the reference imaging exam for diagnosing PUV. In children, the indications for urological CT scans are less frequent owing to its irradiating nature and the nephrotoxicity of the contrast product [13]. However, if a urological MRI is unavailable, CT scans are employed to diagnose obstructive urolithiasis and other upper urinary tract uropathies. This is the case in Sub-Saharan Africa where MRI is usually unavailable. Obstructive uropathies predominantly affect the upper urinary tract [14]. In our series, the upper urinary tract was the location of obstruction in 54% of cases. Additionally, the obstruction site was most often on the left side, as also noted in the literature, whether for obstructive CAKUT or urolithiasis [15].

In our study, PUV was the most common obstructive uropathy, accounting for 39% of cases. Likewise, in other African studies, PUV is identified as the leading cause of lower urinary tract obstruction [3] [16]. In contrast, other research has

shown that UPJO is more prevalent, with PUV being the second most common [2] [15]. This discrepancy is likely due to the limited availability of endoscopic resectoscopes for PUV in many medical facilities, leading to the referral of numerous affected newborns to our institution. Other potential causes of urinary tract obstruction, such as ureterocele and ectopic ureter in a ureteral duplex anomaly, are generally regarded as less common [9] [17] [18].

The correlation between obstructive uropathies and other genitourinary malformations is well-documented in the literature [19]-[22]. In our series, 18% of the patients exhibited such associations, with cryptorchidism being the most frequently accompanying malformation with obstructive uropathies.

5. Limitation of the Study

The main limitation is the retrospective nature of the study, which induced some missing data. The lack of some early investigations has influenced the patient's diagnostic profile.

6. Conclusion

Obstructive uropathies are frequently encountered, predominantly due to malformations, and are most commonly diagnosed in infants in our clinical experience. Ultrasound screening of the urinary tract should continue to be the first-line investigation to guide subsequent imaging studies. The etiologies predominantly involve posterior urethral valves, ureteropelvic junction obstruction, and obstructive urolithiasis.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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