

# Contribution of Medical Imaging in the Diagnosis of Urinary Disorders in Children at the Charles de Gaulle University Hospital in Ouagadougou

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## Abstract

**Purpose:** The purpose of our study, which focused on the contribution of medical imaging in the diagnosis of urinary tract diseases in children at the Charles de Gaulle University Hospital of Ouagadougou, was to study the role of medical imaging in the diagnosis of urinary tract diseases in patients aged 15 years or less at the CHUP-CDG. **Patients and Methods:** This was a descriptive cross-sectional study with the retrospective collection covering the period from January 1, 2009 to December 31, 2018, *i.e.*, 10 years. We collected a total of 833 medical imaging examinations, performed in 735 patients. The mean age of the patients was 40 months, infants accounted for 37.69% of the cases. Male patients were more numerous with a sex ratio of 1.53. **Results:** Ultrasonography was performed in 652 patients or 78.27%, ASP RX in 128 patients or 10.88%. URC and UIV were used in 6.53% and 0.68% of patients, respectively. CT and MRI were not performed in our study. The most frequent clinical urinary signs were dysuria (58.13%) and hematuria (43.94%). Ultrasonography was the most requested examination (78.27%), followed by conventional radiography (15.37%). Urinary lithiasis was by far the most common urinary condition (46.86%), followed by urinary tract infections (32.19%) and malformative uropathies (14.93%), of which the posterior urethral valve was the most frequent. Imaging was also used to find other conditions associated with urinary tract diseases. **Conclusion:** Medical imaging plays a major role in the diagnosis and management of urinary tract diseases in children. It

has limitations, that is why a formal meeting between clinicians and radiologists is necessary for a better choice of imaging techniques and efficient management of these conditions.

## Keywords

Urinary Disorders, Medical Imaging, Children

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## 1. Introduction

The urinary tract is one of the most important systems in human body. It allows the evacuation of catabolic products in the form of urine and contributes to the maintenance of homeostasis [1].

Pathologies can affect the kidney or the urinary tract. They are congenital or acquired, infectious, lithiasis, tumor, malformative, or traumatic. These conditions are a common cause of acute illness in children [2].

The management of these conditions requires a proper diagnosis beforehand.

Several imaging techniques are used to explore the urinary tract [3]. These are essential: ultrasound, intravenous urography (IVU), retrograde urethrocytography (RUC), computed tomography urography and magnetic resonance urography [3].

These examinations allow for morphological and functional studies of the entire urinary tract, including the renal parenchyma, the upper excretory tract and the bladder [4].

In a study on the “place of imaging in adult urinary tract infections”, Puech *et al.* showed that imaging had a role in the evaluation of the extension and diffusion of the infectious process, and guided therapy through ultrasound and computed tomography [5].

For Sow *et al.* in their study on urolithiasis in children in Senegal, the imaging medium used for diagnosis was the couple ASP/Ultrasound in the majority of cases [6].

In Burkina Faso, very few studies have been conducted on the contribution of medical imaging in the diagnosis of urinary tract diseases in children. The aim of our study is to assess the proportion of these conditions in the black African pediatric radio community, and the current level of contribution of the medical imaging department of the CHUP-CDG in the diagnosis and follow-up of urinary tract conditions in young patients after more than ten years of intervention in the management under these conditions.

## 2. Patients and Method

This was a descriptive cross-sectional study with retrospective collection covering the period from January 1, 2009 to December 31, 2018, *i.e.*, 10 years.

Our study concerned children aged less than or equal to 15 years in whom at

least one medical imaging examination was performed at the CHUP-CDG during our study period that concluded to a urinary tract disorder.

All patients whose medical imaging reports were complete and legible were included.

Patients who were seen for previously diagnosed or treated conditions were not included in our study.

We proceeded to an exhaustive recruitment of all patients whose medical imaging reports carried out at the CHUP-CDG concluded to one or several diseases of the urinary system during our study period.

Data were collected using predefined survey forms and analyzed using EPI Info software in its English version 7.1.5.0. Microsoft Excel 2016 was used to construct the tables and graphs.

The information was collected anonymously to ensure confidentiality. The study was conducted with the formal authorization of the Chief Executive Officer of CHUP-CDG.

### 3. Results

#### 3.1. General and Epidemiological Data

During our study period (January 2009 to December 2018), the medical imaging department of CHUP-CDG recorded a total of 96,805 medical imaging examinations among which 26,841 ultrasounds, 5662 unprepared abdominal radiographs, 60 retrograde urethrocytographies and 5 intravenous urographies.

We collected a total of 1091 examinations concerning the urinary system. This represented 1.13% of all medical imaging examinations performed during this period.

For our study, we retained 833 imaging examinations performed on 735 patients, *i.e.*, an exploitation rate of 76.35%. There were 442 male patients, which represented 60.14% of the cases against 39.86% for females, *i.e.* a sex ratio of 1.53. In addition, we encountered 5 cases of disorder of sexual development, *i.e.* 0.68% of the total number of patients.

The department of origin of the patients was indicated for 718 of the 735 patients, *i.e.*, 86.19% of the total number of patients.

Thus, 368 or 51.25% of the patients were hospitalized and 350 had been seen as outpatients.

Of the inpatients, 171 (47.37%) were from the surgical inpatient and emergency departments combined, and 64 (17.73%) from the infant department. The oncology and intensive care units were less represented with 1.11% and 0.55% of patients respectively.

A history was recorded in 50 patients or 6.80% of the total number.

Ten (10) cases of hydronephrosis and four (4) oligohydramnios were found in the antepartum period during obstetrical ultrasounds, *i.e.* 1.36% and 0.54% of patients respectively. Four (4) cases of fetomaternal infections and six (6) fetal malformations were found, representing 0.54% and 0.82% of patients. The main malformations were bladder extrophy and PRUNE BELLY syndrome.

### 3.2. Clinical Presentations

Thirty-seven (37) patients had no urinary functional signs.

Urinary functional signs were indicated on 796 reports, *i.e.* 95.56% of all reports.

Dysuria was the most common urinary tract dysfunction in 58.23% of cases. In newborns and infants, it was recorded as crying during urination or pushing during urination.

Pain, whether abdominal or pelvic, was found in 18.12% of cases.

Urinary burning and acute retention of urine (ARU) were found in 11.15% and 8.41% of cases respectively.

The frequency of the different urinary functional signs is summarized in **Table 1**.

It should be noted that some patients presented several urinary functional signs at the same time. Thus, dysuria associated with abdominal and/or pelvic pain was found in 78 cases, *i.e.*, 9.80% of the total number of patients. Dysuria associated with urinary burning in 47 cases, *i.e.*, 5.90% of all functional signs. Urinary burning associated with abdominal and/or pelvic pain in 8 cases.

The physical urinary signs were reported on 132 reports, *i.e.*, 15.85% of all examinations.

Hematuria was the most common urinary physical sign found in urinary tract diseases. It was found in 43.94% of the total number of patients with physical signs of urination. It was macroscopic in 80.12% of cases. Abdominopelvic and renal masses were reported in 21.97% of the reports.

Other physical signs were: emission of calculus in the urine and cloudy urine.

### 3.3. Medical Imaging Resources

The medical imaging modalities used in the diagnosis of urinary disorders were: abdominal X-ray without preparation, abdomino-pelvic or urinary tract ultrasound, retrograde urethro-cystography, intravenous urography (IVU).

Ultrasound was performed in 652 patients or 78.27%, X-ray of the abdomen without preparation in 128 patients or 10.88%. Retrograde urethro-cystography

**Table 1.** Frequency of urinary functional signs.

Urinary functional signs	(n = 796)	Percentage (%)
Dysuria	463	58.23
Abdominal/lumbar/pelvic pain	146	18.12
Burning of the bladder	89	11.15
Acute urinary retention	67	8.41
Oliguria	15	2.04
Anuria	14	1.80
Pollakiuria	2	0.25
<b>Total</b>	<b>796</b>	<b>100</b>

and IVU were used in 6.76% and 0.60% of patients respectively (**Table 2**). CT and MRI were not performed.

It should be noted that in some patients several examinations had been performed.

Ultrasound and X-ray of the abdomen without preparation were performed in 50 patients, *i.e.* 34.72% of the total number. Retrograde urethro-cystography and abdomen unprepared X-ray were performed in 48 patients, *i.e.* 6.53% of the total number of patients. Ultrasound and UCR were performed in 2.58% of cases.

On the report cards, the indication was specified in 123 cases, *i.e.* 96.09% of the total number of patients who received this examination.

The most frequent indications were the search for lithiasis, the assessment of dysuria, or a sub-bladder obstruction.

The results of the Rx ASP were normal in 50 cases, *i.e.* 40.65% of the total number of Rx ASPs collected. Seventy (70) cases of urinary lithiasis were found, *i.e.* 56.91% of the pathologies found on Rx ASP. They showed calcifications in projection of the renal areas in 58.85% of cases, bladder and ureteral areas in 23.07% of cases each.

The retrograde urethro-cystography represented 5.76% of the examinations requested in our series performed in 48 patients.

The main indication was suspicion of posterior urethral valves in 39.58% of cases.

Twelve (12) retrograde urethro-cystography were normal or 25% of cases. Thirty (30) or 62.50% of the retrograde urethro-cystography found malformative uropathies.

Valves of the posterior urethra were the main malformative uropathy found at the retrograde urethro-cystography.

The other malformations were: vesico urethral reflux, malformative mega bladder, vesico umbilical fistula, urethral fistula. IVUS was the least performed specialized medical imaging examination in our series. Less than 1% of the total patient population had this examination.

IVUS examinations were normal in two (2) cases. Morphological abnormalities were found in three (3) cases, two (2) cases of pyelo ureteral junction syndrome. One (1) case of delayed renal excretion of POC was also found.

Ultrasound was the most used imaging test in our series, it was performed in 652 patients and represented 88.71% of the tests collected.

**Table 2.** Distribution of patients according to the type of imaging used for diagnosis.

Medical imaging modalities	(n = 833)	Percentage (%)
Urinary/abdominal/pelvic ultrasound	652	78.27
Unprepared abdominal X-ray	128	15.37
Retrograde urethro-cystography	48	5.76
IVU	5	0.60
<b>Total</b>	<b>833</b>	<b>100</b>

These were mainly ultrasound examinations of the urinary tract.

Abdominal, pelvic, and abdominopelvic ultrasound examinations were also ordered for urinary tract disorders.

The main indications for ultrasound were urinary functional disorders, followed by the search for urinary lithiasis and malformative uropathy (Figure 1).

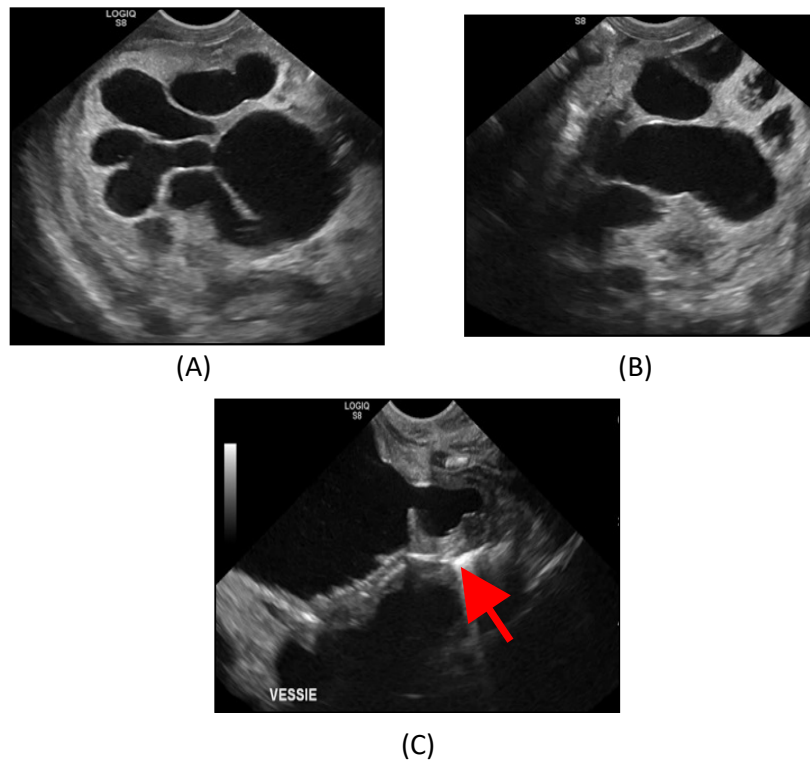
Other indications were: assessment of hypertension, assessment of neonatal distress, assessment of abdominal trauma, presence of calcium oxalate crystals in the urine.

The ultrasound result was normal in 27.51% of cases. Lithiasis and urinary tract infections were the most frequent conditions on ultrasound with 22.11% and 21.23% of cases respectively.

Ultrasound analysis allowed an assessment of the signs of impact on the urinary tract which consisted of:

- Hydronephrosis found in 98 out of 652 ultrasound scans, *i.e.* 15.03% of cases;
- Renal suffering at different stages in 31 out of 652 ultrasounds, *i.e.* 4.75% of cases;
- One case of renal destruction and one case of pyonephrosis;
- Struggle bladder found in 6 cases, *i.e.*, 0.75% of the ultrasounds performed.

The other urinary affections found at the ultrasound were: renal contusions, pyelectasis, nephrocalcinosis, sequelae of urogenital bilharziasis (Table 3).



**Figure 1.** Patient 9 days old. Ultrasound of the urinary tree. Bilateral diffuse pyelo-caliceal and ureteral dilatations (A) (B) associated with a wrestling bladder with a retro pubic subvesical chamber (C). The whole in favor of valves of the posterior urethra (source: CHUP-CDG medical imaging department).

**Table 3.** Frequency of ultrasound findings.

Results	Frequency (n = 796)	Percentage (%)
Normal	219	27.51
Lithiasis disease	176	22.11
Suspicion of urinary tract infection	169	21.23
Impact on the kidneys	130	16.33
Malformative uropathy	44	5.53
Renal tumor	31	3.89
Impact on the lower urinary tract	6	0.76
Other urinary tract diseases	21	2.64
<b>Total</b>	<b>796</b>	<b>100</b>

### 3.4. Urinary Diseases on Medical Imaging

Urinary tract disorders were found in 525 reports, *i.e.* 63.02% of the examinations collected in our series.

These were mainly urinary lithiasis (46.86%), urinary tract infections (32.19%), malformative uropathies (14.93%) and renal tumors (5.90%).

It was found in 246 patients, *i.e.* 46.86% of the urinary tract diseases collected, and 33.77% of all patients.

It was diagnosed mainly by ultrasound in 176 cases, *i.e.*, 71.54% of urinary lithiasis and by Rx ASP in 70 cases, *i.e.*, 28.46% of lithiasis.

Ultrasound and Rx ASP were used in 15 cases (6.10%).

The UCR also contributed to the diagnosis of some cases of urinary lithiasis thanks to the unprepared images taken before opacification.

The most frequent location of urinary lithiasis was bladder in 40.69% of cases. The renal location represented 35.50% of the cases of urinary calculi found. The locations could also be multiple.

In our series, the mean age of discovery of urinary lithiasis was 50.39 months (4.19 years) with extremes of 1 to 180 months. The most affected age group was small children (25 - 60 months) which accounted for 35.77% of cases, followed by older children (5 - 15 years) which accounted for 34.96% of cases.

Neonates were the least affected with 0.41% of cases.

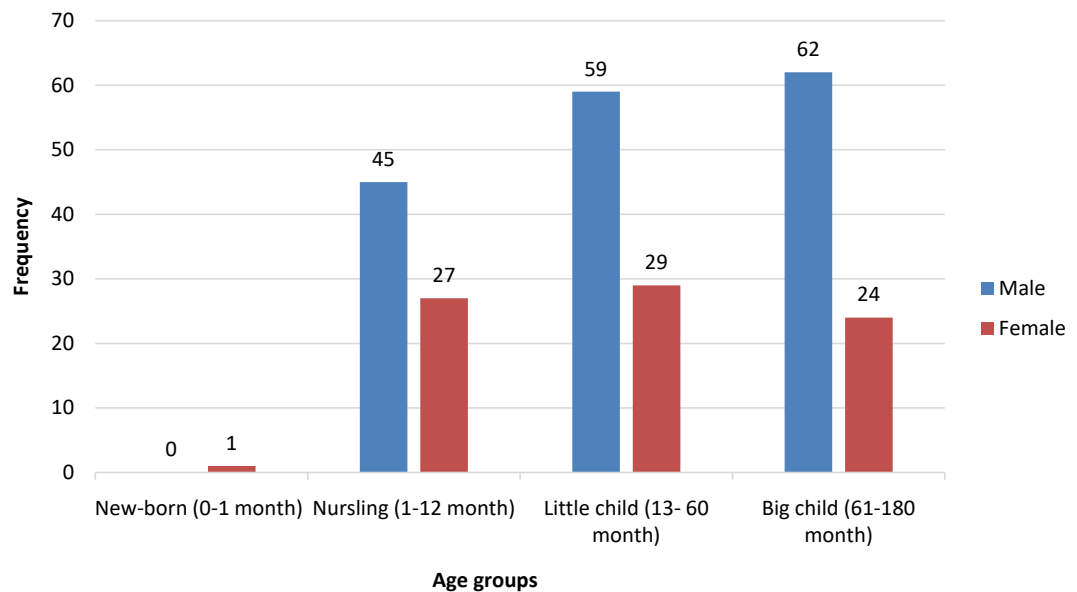
One hundred and sixty-six (166) patients were male, against 80 females, a sex ratio of 2.7.

The frequency of urinary lithiasis according to age and sex of patients is given in (Figure 2).

Urinary tract infection was suspected on medical imaging and mainly on ultrasound in 169 patients in our series. It represented 32.19% of urinary tract infections.

In 90% of the cases it was cystitis and in 10% of the cases pyelitis.

Cystitis was suspected when fine echoes were visualized in the bladder lumen, sometimes with thickening of the bladder wall with a hyperechoic border.



**Figure 2.** Distribution of urinary lithiasis according to age and sex.

Pyelitis was suspected by visualization of thickening of the pyloric wall.

However, the ultrasound results should be correlated with the biological results to confirm the diagnosis of urinary tract infection.

In our series, urinary tract infection was diagnosed mainly in infants, who represented 37.87% of cases, followed by older children (30.77%).

Newborns were the least affected with 7.69% of cases. The majority of patients (59.17%) were female, compared to 40.83% male with a sex ratio of 0.69.

Female infants were more represented (26.04%).

The frequency of urinary tract infections according to age and sex of the patients is given in **Figure 2**.

Malformative uropathies were found on ultrasound and retrograde urethro-cystography. They represented 14.93% of the urinary tract infections, *i.e.*, 79 cases.

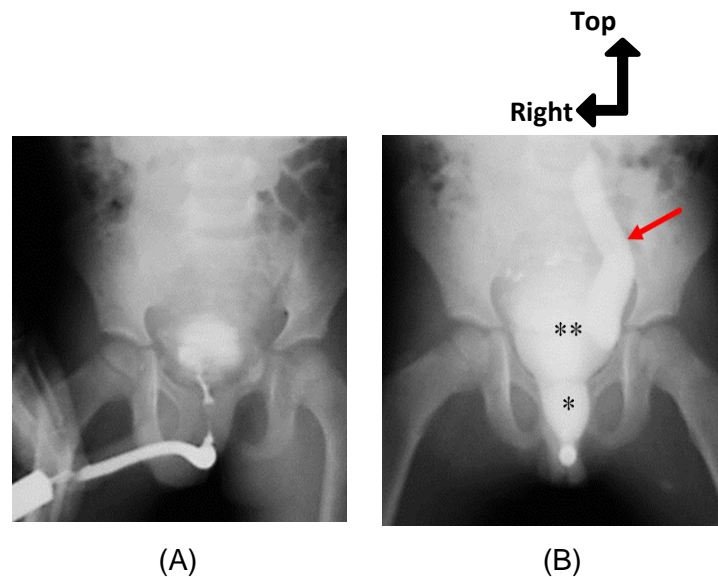
Valves of the posterior urethra represented 53.16% of malformative uropathies found, *i.e.*, 4.2 cases per year, and 8.00% of all urinary disorders. At retrograde urethro-cystography, direct signs of posterior urethral valves were not visualized. In favor of posterior urethral valves, a sub-vesical chamber was found on the film after opacification (**Figure 3**).

Pyeloureteral junction syndrome and urethral stenosis represented 17.39% and 7.25% respectively.

Malformative uropathies were not associated with anomalies of other organs in our series. However, they appeared to have evolved relatively long ago. Valves of the posterior urethra were associated with a pseudo diverticular bladder in 19 cases, resulting in an irregular bladder wall on retrograde urethro-cystography.

Vesicourethral reflux was found in four (4) patients with posterior urethral valves.





**Figure 3.** Retro-retrograde cystography. Significant bladder distension (\*\*), second sub-vesical chamber (\*) in favour of posterior urethral valves with left passive vesico ureteral reflux stage V (arrow) (source: CHUP-CDG medical imaging department).

In our series, the mean age of patients with posterior urethral valve on imaging was 11.91 months, with extremes from 1 to 120 months. The most affected age group was infants with 20 cases or 48.78% of the total number.

In our series, 31 cases of renal tumor were detected, *i.e.*, 5.90% of the urinary tract diseases collected. The main suspected renal tumor was nephroblastoma (**Figure 4**) which represented 58.06% of cases (18 cases). The other tumors were cases of polycystic kidney disease.

The mean age of the patients in whom the diagnosis of nephroblastoma was evoked was 37.39 months (3.12 years) with extremes from 9 to 60 months.

The most affected age range was 25 months to 5 years. There were 10 male patients and 8 female patients, giving a sex ratio of 1.25.

The mean age of patients diagnosed with polycystic kidney disease was 8.85 months with extremes of 1 to 60 months.

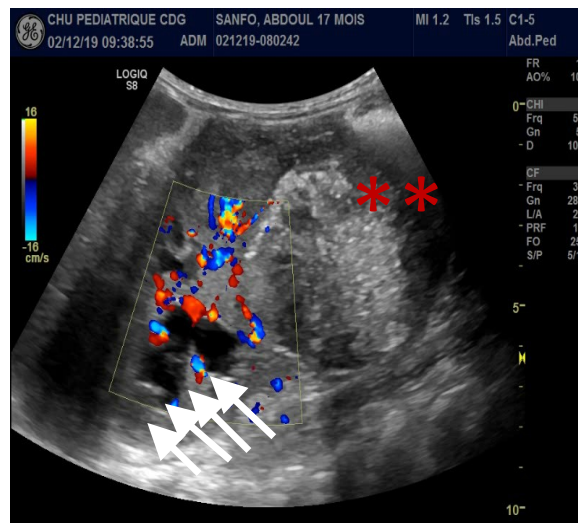
The most affected age group was neonates. There were 6 male patients and 7 female patients, which gives a sex ratio of 0.85.

In front of the urinary signs, the medical imaging examinations found affections or anomalies of other organs often isolated or associated with the affections of the urinary system. They were found in 3.13% of patients. These were mesenteric adenolymphitis in 52.17% of cases, ascites and uratic cysts were found in 21.74% and 8.70% of cases respectively.

## 4. Discussion

### 4.1. Limits and Constraints of Our Study

In carrying out this study, we encountered some limitations and constraints. We can cite the following:



**Figure 4.** 17-month-old male patient received for suspected nephroblastoma. Sagittal ultrasound section of the left kidney: large distal polar mass (\*\*), roughly rounded, heterogeneous tissue (hypoechoic) with probable micro-calcifications (medullary nephrocalcinosis), poorly vascularized on color Doppler. Ectasia of the pyelo-caliceal cavities of the proximal renal stump (arrows) (source: CHUP-CDG medical imaging department).

The relatively small size of our study population is therefore related to the retrospective nature of our study which made us exclude many patients because their imaging reports were either lost, incomplete or illegible. This constitutes one of the major limitations of this study.

As other limitations we can mention the limited nature of the study, which focused only on patients who consulted or were hospitalized at CHUP-CDG; thus, excluding patients who consulted in another health structure and secondarily received a pediatrician. Our results cannot therefore be a reflection of the pediatric population of the city of Ouagadougou.

The difficulty in putting together the bibliographic review was also a limiting factor in our study. Indeed, most of the studies found in the literature have focused only on the contribution of imaging in a single urinary tract condition and rarely on several conditions at the same time. In this context, we encountered difficulties in comparing our results with those of previous studies.

Despite these constraints and limitations, we achieved results that we discussed and commented on.

## 4.2. General and Epidemiological Data

The mean age of the patients in our series was 40 months. Infants were the predominant age group with 37.69% of our study population. Our results are close to those of Ouédraogo [7] and Soubeïga [8] in Burkina Faso who reported respectively an average age of 43.1 months and 45.6 months with 50.3% and 49.5% of infants concerning urinary tract infections and lithiasis in children.

In our study, male patients represented 60.14% of cases with a sex ratio of 1.53.

Our results are similar to those in the literature. Indeed, Meftah *et al.* [9] in Morocco reported 61.81% of boys with urinary disorders at the Ibn-Rochd University Hospital in Casablanca. Oral *et al.* [10] in the USA also found a high proportion of boys (56.7%). These results differ from those of Ouédraogo [7] and Ouédraogo/Yugbaré *et al.* [11] in Burkina Faso who reported 42.6% and 45% male subjects respectively in their studies of urinary tract infection in children.

Some malformative uropathies such as posterior urethral valve are only found in males.

### 4.3. Clinical Presentations

In our study, ten (10) cases of hydronephrosis and four (4) oligohydramnios were found in the antenatal period during obstetrical ultrasound.

In 2012 Khemakhem *et al.* [12] had found antenatally in 10 children with UPV dilatation of the excretory tract associated with oligohydramnios in two cases. Ben Hamouda *et al.* [13] in 2014 reported bilateral ureterohydronephrosis in two cases of bilateral ureteroceles diagnosed at 30 and 32 weeks of gestation. Obstetrical ultrasound thus allows the diagnosis of certain urinary disorders as well as their impact through the evaluation of the amount of amniotic fluid.

Dysuria was the most frequent urinary functional disorder in our series. These results are in line with those of Gansonré [14] and Zongo [15] in Burkina Faso who also reported dysuria as the main urinary functional sign. This could be explained by the fact that parents are more alert to dysuria.

Acute retention of urine was the main functional sign in the series of Alaya *et al.* [16] in Tunisia and Ouédraogo *et al.* [17] in Burkina Faso.

In reality, urinary pathology is characterized by a polymorphism of functional signs. Its insidious nature has as a corollary a high risk of morbidity and mortality, which imposes a urinary check-up in the presence of any abdominal-pelvic or general symptomatology that has not been proven to be etiological in children.

Parents should be made aware of other clinical signs of urinary tract infection, especially in boys.

In our study, hematuria was the most frequent urinary physical sign. These results are consistent with those of Odzébé *et al.* [18] in Brazzaville. Urological hematuria is related to vascular effraction of the tissues affected by the disease in question. They are especially frequent during urinary lithiasis [19].

### 4.4. Medical Imaging Resources

In our study, ultrasound was performed in 78.27% of patients. Our results are close to those of Soubeïga [8] in 2013 in Burkina Faso where ultrasound was performed in 83.17% of children with urinary lithiasis. Kaboré *et al.* [20] in Burkina Faso, had also found that ultrasound was the most performed examination (70.6% of cases) in their study concerning urinary lithiasis in children. Ultra-

sound should be the first-line examination for urinary tract diseases in children. It was the most requested medical imaging test in our study. This could be explained by its safety, its relatively low cost, its non-irradiating character (as opposed to irradiating examinations) especially for children. However, its specificity and sensitivity in the course of urinary tract diseases in children still seems to be poorly perceived when we know that in a context where ultrasound is available, 15.37% of the patients had an unprepared abdomen X-ray.

The prescription of an unprepared abdominal X-ray during urinary tract disease is very different.

Soubéïga [8] in 2013 and de Kaboré *et al.* [20] in 2014 in Burkina Faso reported results close to ours respectively 13.86% and 17.8% of realization of Rx ASP during urinary disorders.

Our figures are much lower than those of Zineb [21] in 2014 in Morocco and Ouédraogo *et al.* [17] in 2014 in Burkina Faso who reported respectively percentages of realization of 75.8% and 51.38%. Some authors report percentages close to 100% especially for suspected urinary lithiasis [8] [18].

Retrograde urethro-cystography and IVU were used in 5.76% and 0.60% of patients respectively in our study.

The most frequent indications for Rx ASP in our series were the search for an obstacle or suspicion of urinary lithiasis.

Mennani [22] in 2018 and Benchouk [23] in 2019 in Morocco had found renal colic as the most frequent indication. These indications show that the Rx ASP is mostly requested in front of symptoms suggestive of urinary lithiasis.

Our study shows its low sensitivity for urinary lithiasis because it is suspected on only 56.91% of the radiographs performed.

The main indication for retrograde urethro-cystography in our study was the suspicion of posterior urethral valves. retrograde urethro-cystography is the first-line examination for the diagnosis of urethral and bladder malformations [24]. In the radiology department, its indication remains the search for RVU in the context of recurrent lower urinary tract infections or malformative uropathies.

The number of cases of RVU (08) diagnosed in our study remains significantly lower than the number of patients (18) who underwent a retrograde urethro-cystography for valves of the posterior urethra.

In the series by Ikejder [25] in 2016 in Morocco, retrograde urethro-cystography found valve images in 44.82% of cases and RVU in 41.37% of cases. In the series of Gansonré [14] in 2019 in Burkina Faso, the retrograde urethro-cystography found a subvesical chamber in 100% of cases and RVU in 9.3% of cases.

Five (5) indications had motivated the realization of the IVU in our series of which two cases for the suspicion of junction syndrome. This IVU came back pathological in three patients including two cases of junction syndrome and one case of delayed excretion of PDC. In the series by Zongo [15] in Burkina Faso, IVU found delayed excretion of POC in two of the four patients in whom it was performed.

Infection of the urinary tract was very frequent on ultrasound in our series (22.99% of cases). It represented 29.7% of the indications for urinary tract ultrasound in the series by Yaogo [26] in 2011 in Burkina Faso. The existence of a urinary tract infection proven by cytobacteriological examination of the urine requires additional explorations in order to search for favourable anatomical factors such as obstructive uropathy or vesico-ureteral reflux. Ultrasound and retrograde urethro-cystography are therefore the first-line methods of investigation in children with urinary tract infections [27]. Other urinary tract conditions such as nephrocalcinosis were found in 2.64% of the ultrasounds in our series. Nephrocalcinosis was associated with urinary lithiasis in more than 76% of the patients in the 2004 study by Diallo *et al.* [28]. Nephrocalcinosis was uncommon in our series, but it is nevertheless a cause of end-stage renal failure when it is cortical [28].

#### 4.5. Urinary Diseases on Medical Imaging

In our series, urinary tract infections represented 32.19% of urinary tract diseases. They were suspected on the basis of ultrasound findings.

In 90% of the cases, these were foci of cystitis. Ten percent (10%) were cases of pyelitis. This could be explained by the relatively lower sensitivity of ultrasound (compared to CT) to detect other infectious diseases, especially non-abscessed pyelonephritis [5]. This requires more efficient imaging methods such as renal scintigraphy or uroscan [5] [29] [30].

In our series, urinary tract infection was diagnosed mainly in infants (29 days to 24 months) who represented 37.87% of the cases. Female patients represented 59.17% of the cases, against 40.83% of males with a sex ratio of 0.69.

These results are similar to those of Ouédraogo/Yugbaré *et al.* [10] in 2012 in Burkina Faso who observed ITU in 35.5% of infants and a sex ratio of 0.81.

Our results are close to those of Bourskraoui *et al.* [31] in 2010 in Morocco who reported 37.1% of infants with a sex ratio of 0.65.

The high frequency of urinary tract infection in infants could be explained by the absence of individual cleanliness at this age. Anatomically, the shortness of the female urethra and its proximity to the gastrointestinal tract could explain the high frequency of UTI in females [32].

Malformative uropathies accounted for 14.93% of urinary tract conditions in our study.

Valves of the posterior urethra represented 53.16% of malformative uropathies found, *i.e.* 4.2 cases per year, and 8.00% of all urinary disorders. These results are close to those of Ikejder [25] in 2016 in Morocco in which posterior urethral valves represented 10.61% of urinary disorders. They are also close to those of Mouafo [33] in 2016 in Cameroon who reported an incidence of 3.1 cases per year.

These low results could be explained by the fact that some patients managed in the pediatric surgery department for posterior urethral valve could have per-

formed the paraclinical examinations in other imaging centers.

In our series the mean age of discovery of posterior urethral valves was 11.91 months. These results are close to those of Gansoré [14] in 2019 and Yaogho [34] in 2016 in Burkina Faso who reported a mean age of 13 and 14.1 months respectively. Sagnan *et al.* [35] in 2018 in Senegal reported a mean age of 15.47 months. The late discovery of posterior urethral valves in our setting could be explained by a delay in diagnosis due to the poor accessibility of specialized pediatric surgery and radiology services, compared to developed countries where diagnosis is most often made antenatally, with perinatal management.

In our series, renal tumors constituted 5.90% of the urinary tract diseases collected. The main renal tumor found was nephroblastoma which represented 58.06% of cases (18 cases).

Our results are lower than those of Douamba *et al.* [36] in 2019 in Burkina Faso, Yao *et al.* [37] in 2016 in Abidjan, and Kaoudi [38] in 2012 in Burkina Faso who reported respective incidences of 5.5; 5; and 3.8 cases per year.

According to the literature, nephroblastoma is the most common renal tumor in children [37] [39]. It accounts for 5% - 14% of all pediatric tumors and 80% - 95% of pediatric renal tumors [40].

The mean age of patients in whom the diagnosis of nephroblastoma was evoked was 37.39 months (approximately 3 years) with extremes of 9 to 60 months.

According to the literature, nephroblastoma is more frequent in children under 5 years of age [39] [41].

The sex ratio of patients diagnosed with nephroblastoma was 1.25 in our series. These results are different from those of Yao *et al.* [37] and Founoun [42] who reported sex ratios of 0.93 and 0.88 respectively.

Several authors in the literature have also reported a predominance of nephroblastoma in female children [39] [41] [43].

## 5. Conclusions

Urinary tract diseases are frequent in children. The medical imaging department of the CHUP-CDG contributes to the management of these disorders.

In our study, ultrasound was the most requested medical imaging examination. Ultrasound, because of its multiple advantages, is the examination of choice for urinary disorders in children.

Other examinations such as retrograde urethrocytography and UIV have seen their indications reduced, especially for the population which is particularly sensitive to ionizing radiation.

The medical imaging techniques available at the CHUP-CDG have made it possible to confirm or invalidate certain conditions such as urinary lithiasis, which was the most frequent urinary condition, and malformative uropathies, of which the posterior urethral valve was the main one.

Other imaging modalities such as CT and MRI could be useful, especially for

the staging of renal tumors and urinary tract infections.

A formal meeting between clinicians and radiologists to plan imaging examinations would also be necessary. This meeting will allow a better choice of imaging techniques, an efficiency of the results and the better care of small patients.

### Conflicts of Interest

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

### References

- [1] McLafferty, E., Johnstone, C., Hendry, C. and Farley, A. (2014) The Urinary System. *Nursing Standard*, **28**, 42-49.
- [2] Robinson, J.L., Finlay, J.C., Lang, M.E. and Bortolussi, R. (2014) Le diagnostic et la prise en charge des infections urinaires chez les nourrissons et les enfants. *Paediatrics and Child Health*, **19**, 320-325.
- [3] Bourlière-Najean, B., Aschero, A., Desvignes, C., Gorincour, G., *et al.* (2017) Exploration de l'appareil urinaire chez l'enfant. *EMC-Radiologie et Imagerie Médicale- Génito-Urinaire- Gynéco- Obstétricale- Mammaire*, **13**, 1-10.
- [4] Lemaître, L., Puech, P., Fauquet, I., Delomez, J., Leroy, C., Fantoni, J.C., *et al.* (2005) Apport de l'imagerie dans la prise en charge des infections de l'appareil urinaire. *Annales d'Urologie*, **39**, 170-196. <https://doi.org/10.1016/j.anuro.2005.09.002>
- [5] Puech, P., Lagard, D., Leroy, C., Dracon, M., Biserte, J. and Lemaître, L. (2004) Place de l'imagerie dans les infections du tractus urinaire de l'adulte. *Journal de Radiologie*, **85**, 220-240. [https://doi.org/10.1016/S0221-0363\(04\)97572-5](https://doi.org/10.1016/S0221-0363(04)97572-5)
- [6] Sow, Y., Coulibaly, M., Fall, B., Sarr, A., *et al.* (2010) La lithiase urinaire de l'enfant: À propos de 20 cas. *Mali Médical*, **25**, 43-48.
- [7] Ouedraogo, A. (2016) Infection du tractus urinaire en milieu pédiatrique: Écologie bactérienne et sensibilité aux antibiotiques au centre hospitalier universitaire pédiatrique Charles de Gaulle de Ouagadougou. Thèse de Doctorat en Médecine, Université de Ouagadougou, Ouagadougou, N° 10, 85 p.
- [8] Soubeiga, S. (2013) Apport de L'imagerie médicale dans la prise en charge de la lithiase urinaire de l'enfant au centre hospitalier universitaire pédiatrique Charles De Gaulle de Ouagadougou: A propos de 101 cas. Thèse de Doctorat en Médecine, Université de Ouagadougou, Ouagadougou, N° 233, 90 p.
- [9] Meftah, S., Belhaj, K., Zahi, S., Mahir, L., Lmidmani, F. and El Fatimi, A. (2016) Troubles urinaires chez l'enfant: Quelle place pour l'exploration urodynamique? *Journal de Réadaptation Médicale. Pratique et Formation en Médecine Physique et de Réadaptation*, **36**, 203-211. <https://doi.org/10.1016/j.jrm.2016.10.002>
- [10] Oral, O., Toprak, M.H.H., Uysal, F., Bostan, O.M. and Cil, E. (2019) The Frequency of Asymptomatic Urinary System Abnormalities in Children Detected with Cineurography Imaging during Angiocardiography. *Cardiology in the Young*, **29**, 119-122. <https://doi.org/10.1017/S1047951118001828>
- [11] Ouédraogo/Yugbaré, S., Kouéta, F., Dao, L., Minoungou, J., Ouédraogo/Traoré, R. and Sanou, I. (2012) Infection du tractus urinaire chez l'enfant: Aspects épidémiologiques et bactériologiques au centre hospitalier universitaire pédiatrique Charles de Gaulle de Ouagadougou (Burkina Faso). *Mali Médical*, **27**, 11-17.

- [12] Khemakhem, R., Ahmed, Y.B., Meftah, S., Jlidi, S., Charieg, A., Louati, H., *et al.* (2012) Les valves de l'urètre postérieur: À propos de 38 cas. *Journal de Pédiatrie et de Puériculture*, **25**, 242-248. <https://doi.org/10.1016/j.jpp.2012.06.006>
- [13] Hamouda, H.B., Bouchahda, H., Ghanmi, S., Wannas, S., Soua, H., Hamza, H., *et al.* (2017) Diagnostic prénatal et prise en charge de deux cas d'urétérocèles bilatéraux sur uretères simplex. *Archives de Pédiatrie*, **24**, 860-864. <https://doi.org/10.1016/j.arcped.2017.06.001>
- [14] Gansonré, N. (2019) Valves de l'urètre postérieur: Apport échographique et cystographique dans le centre hospitalier universitaire pédiatrique Charles de Gaulle de Ouagadougou à propos de 32 cas. Mémoire d'études spécialisées en Radiodiagnostic et Imagerie Médicale. Université Joseph Ki-Zerbo, Ouagadougou, N° 202, 88 p.
- [15] Zongo, P. (2018) Etat des lieux des valves de l'urètre postérieur avant le traitement par résection endoscopique au centre hospitalier universitaire pédiatrique—Charles de Gaulle: Aspects épidémiologiques, cliniques, thérapeutiques et évolutifs. Thèse de Doctorat en Médecine, Université Joseph Ki-Zerbo, Ouagadougou, N° 144, 141 p.
- [16] Alaya, A., Nouri, A. and Najjar, M.F. (2012) Evolution épidémiologique de la lithiase urinaire infantile en Tunisie. *La Tunisie Médicale*, **90**, 518-523.
- [17] Ouédraogo, I., Napon, A.M., Bandré, E., Ouédraogo, F.S. and Tapsoba, W.T. (2015) Les calculs urinaires de l'enfant au Burkina Faso: À propos de 67 cas. *The Pan African Medical Journal*, **20**, Article No. 352.
- [18] Odzebe, A.S., Bouya, P.A., Berthe, H.J. and Omatassa, F.R. (2010) Chirurgie à ciel ouvert de la lithiase urinaire au CHU de Brazzaville: Analyse de 68 cas. *Mali Médical*, **25**, 32-35.
- [19] Traxer, O., Lechevallier, E. and Saussine, C. (2008) Lithiase urinaire de l'enfant. *Progrès en Urologie*, **18**, 1005-1014. <https://doi.org/10.1016/j.purol.2008.09.037>
- [20] Kaboré, F.A., Kambou, T., Zango, B., Ouattara, A., Lechevalier, E., Karsenty, G., Simporé, M., Lougué/Sorgho, C., *et al.* (2013) Épidémiologie d'une cohorte de 450 lithiases urinaires au CHU Yalgado Ouédraogo de Ouagadougou (Burkina Faso). *Progrès en Urologie*, **23**, 971-976. <https://doi.org/10.1016/j.purol.2013.04.014>
- [21] Zineb, E. (2014) La lithiase urinaire chez l'enfant: Expérience de l'hôpital d'enfants de Rabat. Thèse de Doctorat en Médecine, Université Mohammed V de Rabat, Rabat, N° 172, 141 p.
- [22] Mennani, F.E. (2018) Prise en charge de la lithiase rénale: Critères de choix des modalités thérapeutiques. Thèse de Doctorat en Médecine. Université Cadi Ayyad, Marrakesh, N° 161, 139 p.
- [23] Benchouk, M. (2019) Imagerie de la lithiase urinaire: Attentes de l'urologue pour une meilleure prise en charge. Thèse de Doctorat en Médecine, Université Cadi Ayyad, Marrakesh, N° 21, 150 p.
- [24] Birraux, J., Gapany, C. and Parvex, P. (2012) Les valves de l'urètre postérieur. *Pædiatrica*, **23**, 10-12.
- [25] Ikejder, Y. (2016) Les valves de l'urètre postérieur chez l'enfant. Thèse de Doctorat en Médecine, Université Cadi Ayyad, Marrakesh, 106 p.
- [26] Yaogo/Bouda, B. (2011) Bilan des activités échographiques pédiatriques dans le service de radiodiagnostic et d'imagerie médicale du Centre hospitalier universitaire pédiatrique Charles de Gaulle à Ouagadougou au Burkina Faso. Thèse de Doctorat en Médecine, Université de Ouagadougou, Ouagadougou, N° 211, 163 p.
- [27] Guillot, M., Eckart, P. and Dacher, J. (1998) Imagerie de première intention dans l'infection urinaire de l'enfant. *Archives de Pédiatrie*, **5**, 282S-284S.



[https://doi.org/10.1016/S0929-693X\(98\)80150-4](https://doi.org/10.1016/S0929-693X(98)80150-4)

- [28] Diallo, O., Janssens, F., Hall, M. and Avni, E.F. (2004) Type 1 Primary Hyperoxaluria in Pediatric Patients: Renal Sonographic Patterns. *American Journal of Roentgenology*, **183**, 1767-1770. <https://doi.org/10.2214/ajr.183.6.01831767>
- [29] Iacobelli, S., Bonsante, F. and Guignard, J.P. (2009) Infections urinaires en pédiatrie. *Archives de Pédiatrie*, **16**, 1073-1079. <https://doi.org/10.1016/j.arcped.2009.03.001>
- [30] Renard-Penna, R., Ayed, A., Roupret, M., Richard, F. and Grenier, P. (2008) Comment optimiser l'uroscanner pour une étude de la voie excrétrice. *Journal de Radiologie*, **89**, 1445. [https://doi.org/10.1016/S0221-0363\(08\)76397-2](https://doi.org/10.1016/S0221-0363(08)76397-2)
- [31] Bouskraoui, M., Sab, I.A., Draiss, G., Bourrouss, M. and Sbihi, M. (2010) Épidémiologie de l'infection urinaire chez l'enfant à Marrakech. *Archives de Pédiatrie*, **17**, S177-S178. [https://doi.org/10.1016/S0929-693X\(10\)70921-0](https://doi.org/10.1016/S0929-693X(10)70921-0)
- [32] Rouvière, H. and Délmás, A. (1992) Appareil Urinaire. Anatomie Humaine. Edition Masson, Paris, 519-563.
- [33] Tambo, F.F.M., Fossi, K.G., Kamadjou, C., Mbouche, L., NwahaMakon, A.S, Birraux, J., et al. (2016) Challenges in the Diagnosis and Management of Acquired Non-traumatic Urethral Strictures in Boys in Yaoundé, Cameroon. *Case Reports in Urology*, **2016**, 1-4.
- [34] Yaogho, D. (2017) Valves de l'urètre postérieur au Centre Hospitalier Universitaire Pédiatrique Charles de Gaulle (CHUP-CDG): Aspects épidémiologiques, cliniques, paracliniques, thérapeutiques et évolutifs (à propos de 30 cas). Thèse de Doctorat en Médecine, Université de Ouagadougou, Ouagadougou, 139 p.
- [35] Sagna, A., Ndoeye, M., Mbaye, P.A., Ngoy, M., Ngom, G. and Fall, I. (2018) La résection endoscopique postnatale des valves de l'urètre postérieur. *Uro' Andro*, **1**, 409-414.
- [36] Douamba, S., Nagalo, K., Ouédraogo, I., Salia, O., Bandré, E. and Yé, D. (2019) Aspects Thérapeutiques et Évolutifs du Néphroblastome au Centre Hospitalier Universitaire Pédiatrique Charles de Gaulle. *Health Sciences*, **20**, 55-58.
- [37] Yao, A., Couitchéré, L., Atimere, Y., Ouattara, J., Armah, S. and Oulai, S. (2016) Le Néphroblastome à Abidjan: Aspects épidémiologiques, cliniques et évolutifs. *Revue Internationale des Sciences Médicales*, **18**, 47-50.
- [38] Kaoudi, A.D. (2012) L'imagerie médicale dans la prise en charge des cancers pédiatriques au sein des centres hospitaliers universitaires de Ouagadougou: Place actuelle et perspectives. Thèse de Doctorat en Médecine, Université Joseph Ki-Zerbo, Ouagadougou, N° 161, 104 p.
- [39] Schleiermacher, G. and Brisse, H. (2006) Le néphroblastome. *Oncologie*, **8**, 555-562. <https://doi.org/10.1007/s10269-006-0450-y>
- [40] Desvignes, C., Gorincour, G., et al. (2013) Tumeurs du rein et des voies excrétrices chez l'enfant. *EMC-Radiologie*, **1**, 440-456.
- [41] Perlman, E. and Boccon-Gibad, L. (2004) Tumeur du rein de l'enfant. *Annales de Pathologie*, **24**, 516-535. [https://doi.org/10.1016/S0242-6498\(04\)94016-3](https://doi.org/10.1016/S0242-6498(04)94016-3)
- [42] Founoun, R. (2017) Le néphroblastome: Aspects chirurgicaux au sein du service de chirurgie infantile de CHU ohamed VI. Thèse de Doctorat en Médecine, Université Cadi Ayyad, Marrakesh, N° 166, 158 p.
- [43] Diezi, M., Terciers, S., Osterheld, M.C. and Joseph, J.M. (2007) Tumeurs rénales de l'enfant. *Revue Médicale Suisse*, **3**, 360-365.