*International Journal of Health Sciences and Research*
*Vol.11; Issue: 1; January 2021*
*Website: www.ijhsr.org*
*Original Research Article* *ISSN: 2249-9571*

# Uroscannographic Profile of Urolithiasis at Marie Biamba Mutumbo Hospital in Kinshasa, Democratic Republic of Congo

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## ABSTRACT

**Background and purpose:** Imaging plays an essential role in the management of stones. It makes it possible to make the diagnosis, to locate it, to measure its dimension, its density and to orient on its chemical composition. But data on the urolithiasis profile of urolithiasis in the DRC are fragmentary. The purpose of the study is to assess the extent of Uroscan in the diagnosis of urinary tract stones in patients examined at Marie Biamba Mutombo Hospital.
**Methods:** This is a descriptive study of 79 patients who performed a CT scan at HBMM during the period from 2013 to 2018. The sociodemographic, clinical characteristics and the results of the CT scan were studied.
**Results:** 79 patients who performed the uroscan were studied, of which 58.2% were men. The mean age of these patients was 44.5 ± 17.1 years. Clinically, the majority of uroscans were indicated for renal colic and check-up (77.2% respectively). The frequency of lithiasis after CT scan was 38.5% with 5.1% recurrence. Of the 79 patients selected, 119 lithiasis were identified, mostly located in the kidney (63.9%), of which 50.4% were microlithiasis. The majority of these lithiases had a composition orientation of phosphate (42.9%), uric acid and oxalate (28.6% respectively). Several abnormalities associated with lithiasis were found on CT in addition; with the most frequent a renal cyst (27.4%).
**Conclusion:** The uroscanner is an essential examination in the management of lithiasis pathologies, it gives the precise localization, orients on the chemical composition, takes the size and guides the therapeutic attitude.

***Keywords:*** Uroscanner, profile, urolithiasis, HBMM, RDC

## INTRODUCTION

Urolithiasis poses a public health problem because of its frequency, complications and the high cost of its management. The correct management of an attack of renal colic often requires diagnostic imaging, and when it is done, it must be reliable. The Uroscan offers high sensitivity in the identification of urolithiasis [1]. However, its systematic use generates an additional financial cost [2].

Indeed, the Uroscan provides information on the number, size, location and density of stones, all data essential for treatment [3]. The biochemical nature of stones is important in the choice of therapy: for example, a stone of uric acid can benefit from a specific hygienodietetic treatment [4].

This information, based on the measurement of the spontaneous density of urinary stones, is too often imprecise in other imaging studies and accurate for the

CT scan. The Uroscan thus visualizes the 16 minerals that enter into the biochemical composition of urinary stones [5]. In Uroscanner, this computational density is estimated by measuring the average Hounsfield density (UH): for a 120 kV propeller, it is accepted that the average density is 500 ± 100UH for uric acid, between 579 and 753UH for the struvite, 483 and 939UH for cystine, 1183 and 1651UH for calcium phosphate and 1407 and 1883UH for calcium oxalate [6].

Despite the important role played by Uroscan in the diagnosis of lithiasis, few studies have been carried out in Africa, no study in the Democratic Republic of Congo. Hence the importance of this study in order to fill this void. The objective of this study is to assess the extent of Uroscan in the diagnosis of urinary tract stones in patients examined at Marie Biamba Mutombo Hospital.

## PATIENTS AND METHODS

The present work was a descriptive observational study, which was conducted during the period from June 2016 to June 2018. It was performed in the imaging department at Biamba Marie Mutombo Hospital for urolithiasis.

The study population consisted of all patients referred for CT scan of any age without gender discrimination during the study period. The eligibility criteria for the study were radiological only, namely the presence of urolithiasis on the CT scan. Any patient not presenting with urolithiasis was automatically ineligible.

Analysis of exam vouchers, acquisition protocols and the PACS system provided information relevant to this study.

The parameters of interest of three kinds: socio-demographic data (age, sex); clinical-biological data (risk assessment of iodine injection) and uroscannographic data.

All the examinations were carried out on a 64-strip scanner from SIEMENS SOMATON put into service since 2008 and an automatic injector for contrast product from MEDRAD.

The images were read by a radiologist with more than 10 years of experience. The results were recorded in an ad hoc survey sheet containing the socio-demographic and clinical-biological data beforehand. The tomodensitometric elements sought were: technically, the use or not of contrast, the type of hyperdiuresis, the normal or elongated acquisition time, the presence of the calculus, its location, its size and its density, the character obstructive or not of the calculus, the morpho-anatomical anomaly of the excretory tracts and the associated pathologies.

Data processing was performed using Excel 2010 and SPSS version 21.0 software. Descriptive statistics allowed us to calculate frequencies, means and standard deviation. The proportions were compared using a Chi-square test. $p < 0.05$ was the threshold of statistical significance. The study had respected the rules of confidentiality, justice and patient beneficence.

## RESULTS

### General characteristics of the study population

In total, 79 uroscanner protocols with urolithiasis (41 unique and 38 multiple) out of 208 uroscans performed, ie a frequency of 38%; were examined in this study, we identified 119 lithiasis and were the subject of the study. The general characteristics of patients with lithiasis are given in Table 1.

The average age of the patients with lithiasis was 42.2 ± 14.1 years with the extremes of 15 and 86 years, the age group of 41-59 years was the most represented (46.8%). Men were more represented than women, with an M / F sex ratio of 1.4.

Renal colic (77.2%) and follow-up (77.2%) were the most common indications for Uroscan. Furthermore, Table 1 shows that 50% of these Uroscans used intravenous hyperhydration, image acquisition was normal in 88.2% of patients.

**Table 1. General characteristics of the study population**

| Variables | n=79 | % |
|---|---|---|
| **Age** | | |
| ≤20 years | 2 | 2.5 |
| 21-40 years | 31 | 39.3 |
| 41-59 years | 37 | 46.8 |
| ≥60 years | 9 | 11.4 |
| **Sex** | | |
| Male | 46 | 58.2 |
| Female | 33 | 41.8 |
| **Indications** | | |
| Renal colic | 61 | 77.2 |
| Control | 61 | 77.2 |
| Voiding disorder assessment | 27 | 34.2 |
| Etiological assessment of hematuria | 23 | 29.1 |
| Hydronephrosis assessment | 17 | 21.5 |
| Repeated urinary tract infection | 6 | 7.6 |
| **Technical** | | |
| **Hyperdiuresis (n = 14)** | | |
| Furosemide | 4 | 28.6 |
| Oral hyperhydration | 3 | 21.4 |
| IV hyperhydration | 7 | 50.0 |
| **Acquisition time** | | |
| Normal | 105 | 88.2 |
| Elongate | 14 | 11.8 |

## Diagnostic interpretations

### The characteristics of the calculations

119 stones were counted, the characteristics of which are given in Table 2. It is noted in Table 2 that the great majority of stones were located in the kidney (61.2%); more than half of these stones were from microlithiasis (53.2%) with a predominance of ammonium phosphate (42.9%), uric acid and oxalate (28.6% respectively). 31 stones (16.5%) had obstructed the urinary tract; 69 stones (36.7%) were associated with other urological pathologies.

**Table 2. Characteristics of calculations**

| Variables | n=119 | % |
|---|---|---|
| **Localisation** | | |
| Renale | 76 | 63.9 |
| Ureteral | 33 | 27.7 |
| Bladder | 10 | 8.4 |
| **Cut** | | |
| Micro lithiasis | 60 | 50.4 |
| Intermédiate | 50 | 42.0 |
| Macro lithiasis | 17 | 7.6 |
| **Composition** | | |
| Uric acid | 34 | 28.6 |
| Cystine | 20 | 16.8 |
| Phosphate | 51 | 42.9 |
| Oxalate | 34 | 28.6 |
| **Obstruction** | | |
| Present | 21 | 17.6 |
| Absent | 98 | 82.4 |
| **Associated pathologies** | | |
| Yes | 44 | 37.0 |
| No | 73 | 63.0 |

## Comparison of chemical composition

Table 3 indicates that the age of the patients had a significant influence on the chemical compositions of lithiasis (p = 0.001). It shows that whatever the chemical composition of lithiasis considered, the frequency increased with increasing age of the patient.

**Table 3. General characteristics as a function of chemical composition**

| Variables | Uric acid n(%) | Cystine n(%) | Phosphate n(%) | Oxalate n(%) | p |
|---|---|---|---|---|---|
| Sex | | | | | 0.367 |
| Male | 24(27.9) | 16(18.6) | 34(39.5) | 28(32.6) | |
| Female | 10(30.3) | 4(12.1) | 17(51.5) | 6(18.2) | |
| Age | | | | | 0.001 |
| ≤20 years | 3(25.0) | 3(25.0) | 8(66.7) | 1(8.3) | |
| 21-40 years | 21(42.0) | 10(20.0) | 24(48.0) | 5(10.0) | |
| 41-59 years | 7(14.3) | 5(10.2) | 15(30.6) | 27(55.1) | |
| ≥60 years | 3(37.5) | 2(25.0) | 4(50.0) | 1(12.5) | |
| Cut of lithiasis | | | | | 0.258 |
| Microlithiase | 19(31.7) | 9(15.0) | 22(36.7) | 19(31.7) | |
| Intermédiaire | 11(22.0) | 11(22.0) | 27(54.0) | 12(24.0) | |
| Macrolithiase | 4(44.4) | 0(0.0) | 2(22.2) | 3(33.3) | |
| Localisation of lithiasis | | | | | 0.832 |
| Renal | 23(30.3) | 15(19.7) | 33(43.4) | 20(26.3) | |
| Ureteral | 8(24.2) | 3(9.1) | 15(45.5) | 10(30.3) | |
| Bladder | 3(30.0) | 2(20.0) | 3(30.0) | 4(40.0) | |
| Obstruction | | | | | 0.442 |
| Yes | 9(42.9) | 3(14.3) | 7(33.3) | 5(23.8) | |
| No | 25(25.5) | 17(14.3) | 44(44.9) | 29(29.6) | |
| Associated pathologies | | | | | 0.228 |
| Yes | 14(31.8) | 12(27.3) | 19(43.2) | 11(25.0) | |
| No | 20(26.7) | 8(10.7) | 32(42.7) | 23(30.7) | |

## Different pathologies associated with lithiasis

Figure 1 shows that hydronephrosis (44.9%), renal cyst (27.5%) and junction syndrome (20.3%) were the pathologies

frequently found and associated with lithiasis.

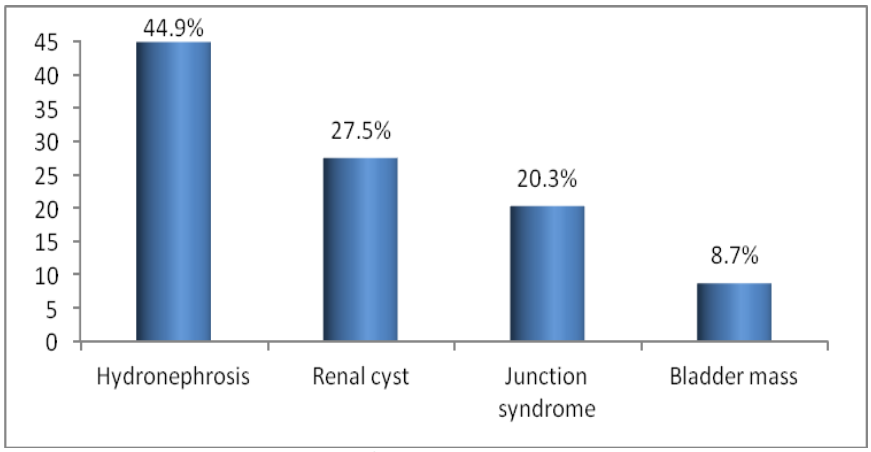


**Figure 1. Frequency of pathologies associated with lithiasis**

## DISCUSSION

The diagnosis of urolithiasis is based on clinical symptoms, abdominal ultrasound and IVU. The integration of these parameters allows to establish a clinical probability score of urolithiasis. But the abdominal CT scan, most often the Uroscan, has the advantage of confirming the final diagnosis. Uroscan, which allows the visualization of the number, size, location and density of stones [5], is the method of choice for imaging the urinary system in cases of signs or suspicion of stones.

Our study showed a predominance of the male sex with 72.3% over the female sex with 27.7% and a sex ratio M / F of 2.6. This finding corroborates several data in the literature reporting a predominance of the male sex in urolithiasis [7, 8, 9]. Indeed, the male sex, through the presence of hyperandrogenism and its structural and functional consequences on the urinary system (endothelial dysfunction and remodeling), is counted among the initiation and progression factors of lithiasis. Other authors like Joual A [10] and Antoine B [11] believe that there is no gender predominance.

The age in our sample was between 15 and 86 years old with a mean of 42.2 ± 14.1 years. This observation is consistent with African, Asian and South American data [7, 8, 9] and reflects the demographic and epidemiological transition experienced, at different speeds, in Sub-Saharan Africa [7]. In addition, advancement in age (41 and 60 years, 44% M and 38.3% F of cases approximately) is considered, through cardiovascular and renal remodeling as well as the constellation of multiple risk factors, such as urinary tract infection, BPH and the most potent cardiovascular (diabetes, hypertension) and renal risk factor. Advanced age has been found in American studies such as that of Dodson and Clarck [7]. The high frequency of old age in this study may lead us to think of a direct interaction between stones and urinary tract infections. From a clinical point of view, the mode of revelation of urinary stones in this series was renal colic, either in its classic form (32.4% of patients) or in the form of abdominal pain (43.6%). The frequency of abdominal pain and renal colic in our cohort was similar to that of Traoré B (26.7%) [12]; of Daffé SI [9] (33.6%), Ongoïba I [8] (40%) and Diakité FG [13] (44%). Renal colic is a tell-tale sign of urinary stones; its presence points directly to lithiasis in the absence of a confirmatory examination. Its pathophysiology can be explained by calculus migration through the urinary tree. Other signs were also found in this study such as voiding disorders 6.1%, hematuria (5%) consistent with the data from Perou.A and Traoré.B [7, 12]. In this series, Uroscan showed a frequency of urolithiasis of 38%; this frequency is multiplied by 6 according

to the data in possession in the DRC eight years ago. Tshipeta and Lufuma first confirmed in 1978 the existence of urolithiasis in Bantu [14] before reporting in 1983 [15], a global annual frequency of 8.9% stones in blacks with CUK (213 stones recorded over a period of 24 years). In fact, all recent epidemiological studies confirm the progression of lithiasis compared to surveys carried out previously on comparable populations [16, 17, 18, 19, 20, 21]. This increase, particularly marked over the past 30 years, is mainly due to changes in socioeconomic level and changes in lifestyle and eating habits [22]. So, we can explain this frequency to change in the health environment of populations and urbanization. Without neglecting the need for a nutritional survey according to the very varied eating habits of the different provinces or better, of the ethnic groups of the DRC. In the United States, all studies agree that the annual prevalence of urolithiasis has almost tripled in 40 years [16, 17]. While in Germany, the epidemiological survey on urolithiasis carried out by the Hesse group had shown an increase in the prevalence of lithiasis by 17% between 1979 and 2001 [19].

Renal location represented 61.2% against 28.2% ureteral location and 10.6% bladder location. This predominance of renal location was observed by Perou A [7] with 81.7% and Roy C [1] with 80%. This can be explained by the fact that the majority of our stones are small and small stones rarely last in the bladder. In our study, microlithiasis was more found with 53.2. against 37.8% of intermediate lithiasis and 9% of macrolithiasis. This observation was made by Ongoïba I [8] and Traoré B [12]. Contrary to what some data in the literature suggest, the calculations frequently have a heterogeneous composition. Although, for reasons of convenience and simplification of the data, most of the publications limit the exploitation of crystal composition to the main species, it should be noted that 90 to 95% of stones have a mixed composition [23]. We found in this study that calcium oxalate dihydrate accounted for 28.6% of stones. Uric acid is also found in 28.6%. Ammonia phosphate dihydrate represents 42.9% and cystine 16.8%. Indeed, calcium oxalate is the most frequent component of urinary stones in most of the European [24], American [25], Asian [26] or African [27] series. In a French cooperative study of 51,747 calculations analyzed between January 2001 and December 2004 by several large French laboratories in the public and private sector, the distribution of the calculations according to the major component was as follows: calcium oxalate clearly appears as the component most frequent majority (71.8% of calculations). Among the other major components, calcium phosphates represent 13.6% of cases, carbapatite being by far the most frequent crystalline species (11.4%). Cystine was only found in 16.8% of our cases. calculations. While in Burkina-Faso, Dessombz et al. [27] recently found a very high incidence of cystine in stones probably related to geophagy, a practice still present in parts of the DRC. The small size of our sample, the influence of the climate on the stones and the possible existence of an unknown metabolic syndrome in our patients are the three factors that can justify the low frequency of uric acid stones compared to those of oxalate of calcium in our series. Struvite was not found in this series, which suggests that the prevalence of lithogenic urease infections has decreased significantly compared to previous decades [28].

In this series, the scanner identified pathologies other than lithiasis among which hydronephrosis came in first position (44.9%), renal cyst in second position (27.5%) and junctional syndrome in third position. (20.3%). The prevalence of renal cyst is well within the range of 55% to 85% reported in the literature [8, 29]. The preponderance of renal cyst can be explained by the fact that the cyst is considered, by its ever increasing prevalence, linked or associated with a certain dietary habit at the base of cell cycle

disruption in Sub-Saharan Africa [9]. As for hydronephrosis, often a consequence of lithiasis aggravated by certain diseases such as infections, BPH, its prevalence in the population is differently assessed by the authors. The frequency of 18.4% found in the present study was higher than the 4% and 6% reported, respectively, in the Sohel HA study and by Ongoiba I [8, 29]. This disparity may be due to differences in the clinical characteristics of the patients studied, in the technique for estimating hydronephrosis on a CT scan, and in the diagnostic criteria for hydronephrosis on imaging. Furthermore, hydronephrosis can be a consequence of obstruction of the excretory tract due to the presence of the calculus. Peru A [7] in 2003 found 30.2% of hydronephrosis due to urolithiasis and Joual A et al [10] found 40% while Mappes CH et al cited by Perou A [7] in Germany observed hydronephrosis in 71% linked to the presence of lithiasis

**Limitations and strengths of this study**

The interpretation of the results of this study should take into account a few limitations. The retrospective nature of our cohort constitutes a significant loss of some useful information. The convenience type sample size could not give statistical tests enough power to detect any associations between the variables of interest.

Beyond the methodological limits, the present study has, however, some strengths. This is the very first study in our community that evaluates lithiasis pathologies diagnosed with the Uroscanner. The conduct of the present study must certainly have contributed to the awakening of awareness of the optimal management of urolithiasis by healthcare providers.

## CONCLUSION

Urinary calculus remains a fairly common condition in the DRC. It is seen at all ages, but it is the older population that is most affected, especially males. During our study, pain was the most frequent clinical symptomatology (over 75%), followed by voiding disorders and hematuria; The lithiasis represented 38% of all patients seen and was renal in the majority of cases. Its composition was made mostly of Phosphate and a high frequency of microlthiasis. Renal cyst, hydronephrosis and junctional syndrome were the other non-lithiasic pathologies most found on the Uroscanner

**Conflict of interest**

The authors declare no conflict of interest.

**Authors' contribution**

DKM and ANN designed and analyzed the statistical data for the study. JMT, MLT, MLN ande AMA supervised the study. All authors have read and approved the final and revised version of the manuscript.

## ACKNOWLEDGEMENTS

We thank all the investigators who participated in the study, the Biamba Marie Mutombo Hospital, who agreed to collect the field data.

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How to cite this article: David Kizunga M, Aliocha Nkodila N, Jean Mukaya T et.al. Uroscannographic profile of urolithiasis at Marie Biamba Mutumbo Hospital in Kinshasa, Democratic Republic of Congo. *Int J Health Sci Res.* 2021; 11(1):145-151.

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