



# Place of urolithiasis in the spectrum of urological pathologies, practices and use of endourological procedures in the management of calculi of the upper urinary tract: results of a survey of referral centres in Africa

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## Abstract

Our aim was to determine the current trend of endourology in the management of upper urinary tract calculi in Africa referral centres. We conducted an online multiple-choice questionnaire survey involving 46 centres from 27 countries using a structured well-designed Google Form (®) questionnaire. The questionnaires were distributed to the head of service through their emails. The questions collected demographic data about the centre, the epidemiology of urolithiasis, diagnostic means and management of upper urolithiasis, especially access to endourology procedures and their practices. Descriptive analyses were performed. The participation rate was 77.9%. Urinary lithiasis was one of the three main pathologies encountered in 42/46 centres. 33 centres had easy access to CT scanners and 34 had operating theatres equipped with endo-urological surgery equipment. Of these 34 centres, 30 perform endourology for the management of upper urinary tract stones. Rigid ureteroscopy is the main technique used by the centres. It is the only endourology technique used for stone management by 12 centres (40%). 7/30 (23.3%) have the option of performing rigid ureteroscopy, flexible ureteroscopy and percutaneous nephrolithotomy. The frequency of procedures varies widely, with 43.3% rarely performing endourological surgery. Seventeen centres have their operating theatre equipped with a fluoroscope and 6/42 centres have extracorporeal lithotripsy. Open surgery is still used in 29/42 centres (69.1%). Laparoscopy is available in 50% of centres, but none reported performing laparoscopic lithotomy. In Africa, urinary lithiasis plays an important role in the activities of referral centres. Modern management techniques are used to varying degrees (not all centres have them) and with very variable frequency. Open surgery is still widely performed as a management. Rigid ureteroscopy is the main endourological technique. It is essential to develop the practice of modern urology in Africa, mainly endourology.

**Keywords** Urolithiasis · Epidemiology · Practice, Endourology · Modern Urology For Africa · Africa

## Introduction

Urinary lithiasis is the third most common disorder of the urinary tract, after urinary tract infections and prostate disease [1]. Its prevalence is constantly increasing throughout

the world, making it a real problem requiring huge public health efforts [2]. This prevalence varies according to geographical area [3]. Until the early 1980s, open surgery was the main technique for stone removal [4]. Considerable progress has been made in recent decades to maximise stone management using minimally invasive techniques. Currently, there are several techniques with indications that sometimes

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differ between learned societies [5]. In 2009, Honeck et al. [4] published a report from a German centre reporting that open surgery accounted for 5.4% of the procedures used. In Africa, epidemiological data on urolithiasis are scarce [6]. The lack of equipment and technical skills in endo-urology means that open surgery is the principal means of managing kidney and ureteral stones. Until 2020, the trend for open surgery was over 60% [7]. In the light of these findings and to establish the current situation, the authors conducted a survey of referral centres in sub-Saharan Africa, with the primary aim of defining the place of urolithiasis in the spectrum of urological pathologies. Second, the aim was to determine the practice and techniques used in the management of upper urinary tract stones.

## Methodology

After constructing the questionnaire on Google Formular, the authors identified the centres and potential participants. These were mainly tertiary-level public hospitals with a urology department and/or accredited to train urological surgeons. To validate the questionnaire, an evaluation test was carried out by the main authors and then sent by e-mail or WhatsApp. In addition to the questionnaire, the message sent contained general information on the survey and its objectives. The items requested covered information on the centres, the epidemiology of frequent urological pathologies, access to CT scanners and the availability of fluoroscopes in the centres, the availability of extracorporeal lithotripsy in the centre and of endourology equipment in the OR, the endourology practice and techniques used, the current practice of open surgery, the presence of a laparoscopy column in the OR and the possibility of laparoscopic cure of upper urinary tract calculi. After collection, data were extracted on Excel for analysis. The calculation was purely arithmetical. No correlation was made. Mapping was performed using Google Sheets.

## Results

The survey questionnaire was sent to 59 centres in 36 countries. A total of 46 centres from 27 countries responded, representing a participation rate of 77.9% and 75%, respectively, in terms of centres and countries. Figure 1 shows the countries that took part in the survey.

Table 1 gives details of the centres that took part in the survey. In terms of frequency, urinary lithiasis was one of the three main pathologies encountered in 40/42 centres. It was the first condition treated in 7 centres, the second in 12 centres and the third in 13 centres. Two centres did not list it as one of the three main conditions.

Thirty-three (71.7%) centres responded to have easy access to scanners while 11 centres responded to difficulty in accessing. Two respondents said they did not have a scanner in their centre. In response to having endo-urological surgical equipment in the operating room? 34(73.9%) responded yes while 12 responded no. Of these 34 centres, 30 perform endourology for the management of upper urinary tract stones with varying frequency (Table 2). Of these 30 centres, seventeen (56.6%) began practising endourology less than 10 years ago (Table 2).

Regardless of the stone's size, open surgery is still employed to treat kidney stones 29(63%) responding centres (Table 2) of the 30 centres who responded in performing endourology, 12(40%) use only rigid ureteroscopy as a management technique while 7(23.3%) have the option of performing rigid ureteroscopy, flexible ureteroscopy and percutaneous nephrolithotomy. The frequency of procedures (rigid ureteroscopy, flexible ureteroscopy and percutaneous nephrolithotomy) varies greatly from centre to centre, with 13(43.3%) centres rarely performing endourological surgery for the management of upper urinary tract stones (Table 2).

Seventeen centres have a fluoroscope in their operating theatre. Extracorporeal lithotripsy is available in 5(10.9%) centres (Table 3). Fifty percent of those surveyed responded that their operating room had a laparoscopic column. No centre has responded to perform laparoscopic lithotomy.

## Discussion

This study was designed to gather information on the epidemiology of urolithiasis, practices and endourological management of upper urinary tract stones in African referral centres. Existing data in the current African literature mainly consist of single-centre reports on epidemiology, diagnosis and management. This survey, which includes a large number of centres from different geographical areas, takes a broader view. In the era of endourology, exploration of this subject remains crucial in Africa, bearing in mind that urolithiasis remains an under-studied subject and that practice and overall management have not been the subject of previous studies.

Urolithiasis is very common in urology. It is linked to a number of personal (heredity, comorbidity, nutrition and occupation), environmental and geographical factors [8]. Its incidence and prevalence are constantly increasing. Worldwide, its incidence has increased by 48.57% in 29 years (from 1990 to 2019) [9]. Population-based data on the epidemiology of urolithiasis are available for several regions of the world. In Africa, data on the epidemiology of urolithiasis are derived from hospital-based studies [10]. It has been reported that the exact incidence of urolithiasis in sub-Saharan Africa is unknown; this is due to under-reporting and



**Fig. 1** Map of countries that took part in the survey

the lack of large-scale epidemiological studies. In a review including 15 studies and 1,480 patients from sub-Saharan Africa, the mean age of patients was 39.1 years, and men were predominantly represented [7]. This average age seems to reflect the African population, which is generally young.

The data from this survey are the first to define the place of urolithiasis in the spectrum of urological pathologies treated in referral hospitals in Africa. It clearly shows that urolithiasis occupies an important place in hospital activities. These figures are generic and merit further investigation

by carrying out population surveys to determine the various epidemiological parameters associated with urolithiasis.

CT imaging is the best method for diagnosing urinary stones. With a sensitivity of 95% and a specificity of 96% for the detection of urinary stones, it outperforms imaging modalities (standard radiography and ultrasound). It allows precise location, measurement of the size and characterisation of the stone. In addition to the characteristics of the stone, the scan can identify any anomalies or associated anatomical variations likely to influence the choice of treatment

**Table 1** Information on the centres that took part in the survey

Country	City	Name of the centre
Bénin	Porto Novo	Centre hospitalier universitaire départementale Ouémé-Plateau
	Cotonou	Centre National Hospitalier et Universitaire Hubert Koutoukou Maga
Burkina Faso	Bobo Dioulasso	Centre Hospitalier Universitaire Souro Sanou de Bobo Dioulasso
	Ouagadougou	Centre Hospitalier Universitaire Yalgado Ouedraogo
Burundi	Bujumbura	Centre Hospitalier Universitaire de Kamenge
Cameroon	Douala	Hôpital Laquintinie
	Douala	Hôpital Général de Douala
	Bamenda	Regional Hospital Bamenda
Congo	Brazzaville	Centre Hospitalier Universitaire de Brazzaville
	Brazzaville	Hôpital de référence de Talangai
Côte d'Ivoire	Abidjan	Centre Hospitalier Universitaire de Treichville
Djibouti	Arta	Hôpital Régional d'Arta
Ethiopia	Addis Ababa	Saint Paul's Hospital Millennium Medical College
	Wolaita	Wolaita Sodo university comprehensive Specialized hospital
Ghana	Cape Coast	Cape Coast Teaching Hospital
Guinée	Conakry	Hôpital National Ignace Deen
Kenya	Chogoria	PCEA Chogoria Hospital
	Eldoret	Moi Teaching and Referral Hospital
	Nairobi	Aga Khan University Hospital
	Bomet	Tenwek Hospital
Liberia	Monrovia	John F. Kennedy Medical Center
Madagascar	Antananarivo	Centre Hospitalier Universitaire Joseph Ravoahangy Andrianavalona
Mali	Bamako	Centre Hospitalier Universitaire Kati
	Bamako	Centre Hospitalier Universitaire du Point G
	kati	Centre Hospitalier Universitaire Pr Bocar Sidy sall
Mauritanie	Kiffa	Centre hospitalier de Kiffa
	Nouakchott	Hôpital Cheikh zayed
Niger	Niamey	Hôpital Amirou Boubacar Diallo
Nigeria	Sokoto	Tetfund Centre of Excellence in Urology and Nephrology
	Kano	Aminu Kano Teaching Hospital
RDC Congo	Lubumbashi	Cliniques universitaires de Lubumbashi
République Centrafricaine	Bangui	Centre Hospitalier Universitaire de l'Amitié Sino-Centrafricaine
Rwanda	Kigali	University Teaching Hospital of Kigali
Senegal	Dakar	Hôpital Général Idrissa Pouye
	Dakar	Hôpital Aristide Le Dantec
south africa	Cape Town	Groote Schuur Hospital
Sudan	Wad Medani	Gezira Hospital for Renal Disease and Surgery
	Port Sudan	Prince osman Digna referral Hospital
	Khartoum	Ibn sina Specialized Hospital
Tanzania	Moshi	Kilimanjaro Christian Medical centre
	Zanzibar	Alrahma hospital
	Tanga	Tanga Regional Referral Hospital
Tchad	N'djamena	Hôpital de la Renaissance
	N'djamena	Centre hospitalo-universitaire la Référence Nationale
Togo	Sokodé	Centre Hospitalier Régional de Sokodé
Zambia	Lusaka	Levy Mwanawasa University Teaching hospital

**Table 2** Distribution of centres according to frequency of use of endourology, start of practice and procedures performed

	Qualification	Number (percentage)
Beginning of endourology practice	Less than 5 years	6
	Between 5 and 10 years	11
	More than 10 years	13
Techniques/gestures used	Rigid ureteroscopy	27 (90)
	Flexible ureteroscopy	17 (56, 6)
	Percutaneous nephrolithotomy	14 (46, 6)
	Rigid + flexible ureteroscopy	4 (13, 3)
	Rigid ureteroscopy + percutaneous nephrolithotomy	4 (13, 3)
	Rigid + flexible ureteroscopy + percutaneous nephrolithotomy	7 (23, 3)
Frequency	Often	8
	Sometimes	9
	Rarely	13

**Table 3** Centres with ESWL

Country	City	Centre
Mali	Bamako	Center Hospitalier universitaire Du point G
Madagascar	Antananarivo	Centre hospitalier Universitaire Joseph Ravoahangy Andrianavalona
South Africa	Cape town	Groote Schuur Hospital
Senegal	Dakar	Hospitalier General Idrissa Pouye
Sudan	Khartoum	Ibn Sina specialised Hospital

[11]. Once the characteristics of the stone and the patient's anatomy have been established, the CT scan plays an important role in treatment planning by defining the approach and technique to be chosen. After the operation, the scanner is used to assess the success of the treatment and identify any residual fragments. The ability to accurately measure the size and location of residual fragments is crucial in determining the need for further intervention [12]. One of the main challenges in many African countries is the limited availability of CT scanners, particularly in rural and underserved areas. The high cost of acquiring the equipment can be a problem for centres [13]. Added to this are other technical problems (servicing and maintenance of the equipment, regular power supply, etc.) which can lead to service interruptions. Cost can also be a major barrier to access for many patients in Africa.

The management of upper urinary tract stones depends on stone-related factors (size, location, composition and density), anatomical factors (renal anatomy), technical factors (availability of equipment, presence of the requisite skills and expertise) and also clinical factors (presentation and co-morbidities). There are several therapeutic modalities, ranging from extracorporeal to intracorporeal and minimally

invasive techniques. In the latest recommendations from the European Association of Urology, extracorporeal shock wave lithotripsy occupies an important place in therapeutic strategies. It is included in virtually all treatment algorithms [14]. This technique is only available in 14.2% of the centres that took part in the survey.

Endo-urological and minimally invasive techniques are currently the therapeutic modalities in developed countries. These techniques are generally chosen because of their better preservation of renal function, better stone fragmentation rate and minimal complications and morbidity. This is why ureteroscopy and percutaneous nephrolithotomy have been the most widely practised treatment modalities for years in developed countries [15]. The same cannot be said for the state of practice in Sub-Saharan Africa, where very few centres have facilities for endourology. In a review defining current trends in endourology in Africa, Ayun et al. [7] reported that the rate of open surgery for upper tract stones was close to 70%. This survey confirms this, with less than 30% of centres reporting endoscopic management of upper urinary tract stones. In a recent study carried out in Ogbomoso, Nigeria, by Idowu et al. [16], it was reported that all cases of upper tract stones were surgically removed openly because there were no facilities and equipment for endourology. In addition to this, other factors were incriminated: the level of development, political instability, and difficulties in bearing the costs for patients.

This survey reports that rigid ureteroscopy is the most widely available and used endourological technique. This can be explained on the one hand by the cost of acquisition, the reuse of equipment and the consumption of disposable equipment, which is less expensive than flexible ureteroscopy [17], and on the other hand by its short learning curve compared with other techniques such as flexible ureteroscopy or percutaneous nephrolithotomy. In their publication

on the learning curve for semi-rigid ureteroscopy, Ilias et al. [18] reported that 40 procedures are sufficient for a surgeon to be able to perform semi-rigid ureteroscopy safely. However, for flexible ureteroscopy, the learning curve is long: a minimum of 60 procedures is required to master traditional flexible ureteroscopy [19]. Compared with the techniques mentioned, a surgeon with no prior experience of percutaneous nephrolithotomy needs up to 105 procedures to achieve excellence [20]. Learning these techniques necessarily requires the availability of equipment and the support of an experienced surgeon. These 2 requirements explain the absence of these techniques in African centres.

Laparoscopic stone removal is considered to be a better alternative procedure for the management of large or complex kidney stones than percutaneous nephrolithotomy and open surgery [21]. It has the potential to minimise bleeding, reduce postoperative pain and morbidity [22]. However, it is technically more difficult, takes longer to perform, requires prolonged resumption of feeding and has poor aesthetic results. Laparoscopy offers greater safety and efficacy in special cases (abnormal formation or position) [23]. This is why, in view of these observations, in centres offering the possibility of performing laparoscopic surgery in Africa, this technique can be taught, thereby increasing the therapeutic arsenal and reducing the morbidity and mortality associated with open surgery.

A standard endourology operating theatre should have sufficient space to accommodate the fluoroscopy and monitor, one or two endoscopy columns, the ultrasound and laser machine and instrument trays [24]. For upper urinary tract endourology, the instruments used include the semi-rigid and flexible ureteroscope, the nephroscope, Amplatz dilators and various manipulation forceps [25]. In a publication in the International Society of Urology, the association Modern Urology for Africa reported that acquiring equipment for endourology is a major challenge for African referral centres, making the practice of open surgery more prevalent. Some centres have been equipped thanks to international collaboration [26]. Support still plays an important role in equipping referral centres. According to Asante et al. [27], this situation can be explained by the lack of political will, the low percentage of the budget allocated to health and the absence of insurance systems requiring patients to pay in full for treatment. The various points made about the procurement problem need to be closely studied by local decision-makers in charge of health policy and social issues. It is also high time that manufacturers designed affordable equipment for countries with limited budgets and resources.

Traditionally, the use of fluoroscopy is necessary when performing ureteroscopy. This enables the anatomy to be determined, the stone to be located and the procedure to be performed in complete safety [28]. Ureteroscopy can be performed without a fluoroscope for the management of upper

urinary tract calculi [29]. Apart from the fragmentation results and complications, all authors agree that ureteroscopy without a fluoroscope appears to be safe and effective. However, it must be performed in experienced centres and requires perfect mastery of the traditional technique. The same applies to percutaneous nephrolithotomy, which can be performed without a fluoroscope [30].

## Conclusion

This survey is the first of its kind and scale to be carried out in Africa on this subject. It shows the importance of urinary lithiasis in the activities of referral centres. It also highlights the practice and methods of endourological management of upper urinary tract stones in African referral centres. These centres still regularly perform open surgery to remove stones. This is mainly due to a lack of equipment and technical skills. Rigid ureteroscopy is by far the most widely used endourological technique, although it is not widely available. Targeted advocacy and a set of concrete actions are needed to enable centers to develop the practice of modern urology for Africa, mainly endourology.

**Author contributions** All the authors contributed to at least one stage of this work. From information gathering to analysis, redaction and final reading.

**Data availability** The corresponding author declares that the data is available and can be supplied on request.

## Declarations

**Conflict of interest** The authors declare no competing interests.

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- 11 Usmanu Danfodiyo University College of Health Sciences, Sokoto, Nigeria
- 12 Centre National Hospitalier Et Universitaire Hubert Koutoukou MAGA, Cotonou, Benin
- 13 Centre Hospitalier Universitaire d'Antananarivo, Antananarivo, Madagascar
- 14 Centre Hospitalier Universitaire de Kigali, Kigali, Rwanda
- 15 Centre Hospitalier Universitaire de Kamenge, Bujumbura, Burundi
- 16 Bamenda Regional Hospital, Bamenda, Cameroon
- 17 Hôpital Amirou Boubacar Diallo, Niamey, Niger
- 18 Hôpital La Rénaissence, N'djamena, Chad
- 19 Centre Hospitalier Et Universitaire de Brazzaville, Brazzaville, Congo
- 20 Hôpital National Ignace Deen, Conakry, Equatorial Guinea
- 21 Hôpital Général Idrissa Pouye, Dakar, Senegal
- 22 Centre Hospitalier Universitaire du Point G, Bamako, Mali
- 23 Aga Khan University Hospital Nairobi, Nairobi, Kenya
- 24 Levy Mwanawasa University Teaching Hospital, Lusaka, Zambia
- 25 Groote Schuur Hospital, Cape Town, South Africa
- 26 University Hospital Medical Center at Treichville, Abidjan, Côte d'Ivoire
- 27 Hôpital Aristide Le Dantec, Dakar, Senegal
- 28 University of Yaoundé I, Yaoundé, Cameroon
- 29 Centre Hospitalier Universitaire Ibn Rochd, Casablanca, Morocco