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REVIEW

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Burden of urolithiasis: a systematic review of epidemiological and clinical trends in Somalia

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Abstract

Background Urolithiasis has become a global major disease that affects millions of people every year. The data regarding the disease in sub-Saharan Africa are limited. Our purpose is to evaluate the prevalence, epidemiological, and clinical data related to urolithiasis in Somalia.

Methods Following Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, systematic review utilized Medical Subject Headings (MeSH) on the following sites; PubMed, Web of Science, EBSCO host, EMBase, Medline, and Cochrane Libraries, using the keywords "Urolithiasis", "Urinary stone disease", "Urinary stones" "Renal stone" "Nephrolithiasis", "Kidney stone", "Ureter stone", "Uretero-lithiasis", "Bladder stone", "Cystolithiasis", and "Urethral stone" singly and in combinations terms like "Somalia", "Somaliland", "Puntland" and "Mogadishu" to identify relevant published studies. After removing 57 duplicate articles and those with incomplete published results, 141 articles were screened based on their abstracts and titles. Finally, only six studies were eligible to be included in the final systematic review.

Results Of the six articles included, 14,612 patient records were reviewed for urinary stone disease prevalence, patient demographics, radiological stone characteristics, and urinary stone management. The mean patient age was 34.6. Males were predominantly affected compared to females with 65.7% and 34.3%, respectively. Adults (≥ 18 years old) accounted for 87.9% of the patients while 12.1% being children. Reported urolithiasis prevalence ranged from 8.1% to 17%. Of the 1,442 nephrolithiasis cases, 180 (14.6%) were staghorn calculi while 72.4% had a single stone and 27.6% had multiple stones. The mean stone size was 14.13 mm (± 5.96). The majority of the patients, 389 (36.8%), underwent open lithotomy. Percutaneous nephrolithotomy (PCNL) was performed in 234 (22.1%) of cases, out of which 126 (11.9%) underwent standard PCNL and 108 (10.2%) super mini PCNL (SMP). Ureteroscopic pneumatic surgery (URS) and retrograde intrarenal surgery (RIRS) were performed in 122 (11.5%) and 199 (18%) cases, respectively.

Conclusion Somalia reported high urolithiasis prevalence. Urological centers in the capital have started using the new advanced techniques for stone management, nevertheless, open lithotomy is still predominantly utilized. No study has detailed patient demographics and stone composition has still not been reported.

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1 Introduction

Urinary stone disease incidence and prevalence are continuously rising globally according to the latest literature [1, 2]. Urolithiasis is a painful condition that can affect all organs in the urinary system in all ages and genders [2]. Urolithiasis can be caused by one or a combination of many factors such as water quality, genetic factors, climate, temperature, work environment, foods, and geographical locations [2, 3]. According to the Global Burden of Disease (GBD) 2019 report, the incidence of urolithiasis has increased by over 48% between 1990 and 2019, however, the age-standardized incidence rate (ASIR) has shown a decline in that same period [3]. Similarly, disability-adjusted life years (DALYs) of urolithiasis have also decreased based on the 2019 GBD study [4].

Nephrolithiasis refers specifically to kidney stones. Patients with recurrent episodes tend to have more severe pain and complications that ultimately lead to renal failure and death if not treated on time. The prevalence of nephrolithiasis is globally increasing with a high recurrence rate of up to 50% reported in the literature [5]. Similarly, many parts of the world have reported increased prevalence over the years [6]. The data regarding the prevalence of urolithiasis in sub-Saharan Africa and the Middle East are scarce. There are a few hospital-based studies addressing urolithiasis in the region [7–9]. In Saudi Arabia, urolithiasis prevalence of up to 19% has been reported.

Urinary stone disease has a huge economic burden globally [10]. The expenses are related to emergency visits, outpatient care, admission costs, and both medical and surgical stone management [11]. The financial burden includes indirect and out of pockets which are very challenging to calculate [12]. The rapid technological advancements and the emerging new diagnostic and therapeutic approaches for urolithiasis have also come with more financial constraints due to their sophistication. Notwithstanding, countries in sub-Saharan Africa are adopting the new surgical management strategies due to their minimally invasive nature, and efficiency [13]. The use of several minimally invasive surgical options has been reported in the sub-Saharan region including extracorporeal shock wave lithotripsy (ESWL), retrograde intrarenal surgeries (RIRS), rigid ureteroscopic laser lithotripsy, and percutaneous nephrolithotomy (PCNL) [13, 14].

In this study, we performed a systematic literature review to investigate urinary stone disease prevalence, demographics, and disease management options in Somalia.

2 Methods

We performed this systematic review to investigate the status of urinary stone disease in Somalia including the disease prevalence, burden, demographics, stone features, and the treatment modalities available in the country. We used the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement while doing this review.

2.1 Literature search

Two independent researchers conducted a comprehensive systematic literature search using MeSH terms and a combination of keywords with Boolean operators to retrieve relevant articles and reports from established scientific databases such as PubMed, Web of Science, EBSCO host, EMBase, Medline and Cochrane Libraries. The keywords used include "Urolithiasis", "Urinary stone disease", "Urinary stones" "Renal stone" "Nephrolithiasis", "Kidney stone", "Ureter stone", "Ureterolithiasis", "Bladder stone", "Cystolithiasis", and "Urethral stone" and then combined the terms such as "Somalia", "Somaliland", "Puntland", "Jubbaland", "Hirshabelle", "Galmudug", "Southwest Somalia", "Benadir", and "Mogadishu" to identify relevant studies published up to February 2024. In addition, other related articles that arose during the search from grey literature sources (university bulletins, reports, policy literature, working papers, newsletters, and government documents) were reviewed and added as additional information sources.

2.2 Selection criteria and data extraction

Of the published articles, only the studies written in the English language were included. Abstract papers for academic proceedings and case reports were not considered. After discussion, the parameters of interest such as study author, study site, design, patient demographics, urinary stone characteristics, and surgical management options were summarized.

2.3 Statistical analysis

Descriptive statistics was used for general characteristics by presenting frequency with percentage for categorical data. Using IBM, SPSS v.26, the average stone size (mm) was calculated and presented as mean with standard deviation (SD) from each selected paper.

3 Results

The result of the preliminary database search is shown in the PRISMA flowchart (Fig. 1) which contained a total of 198 records. Two additional reports were identified following a wider grey area search. After removing 57 duplicate articles and those with incomplete

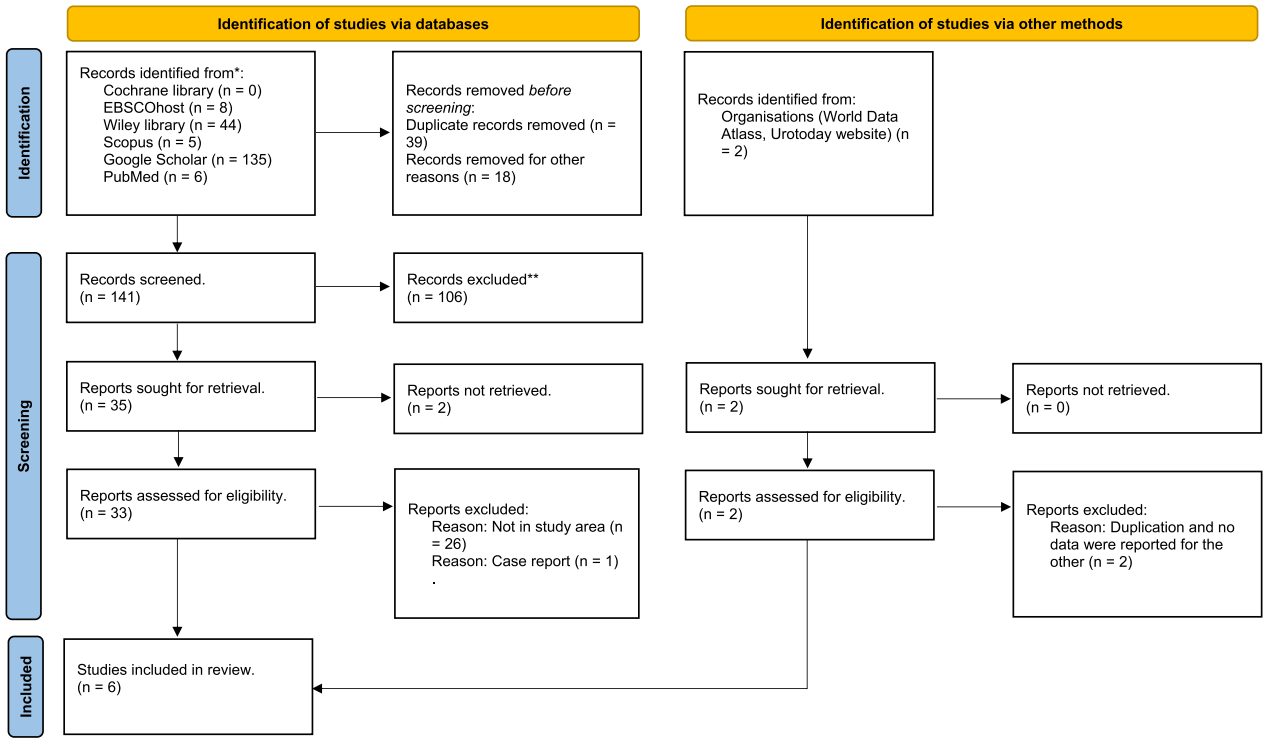

Fig. 1 PRISMA Flowchart of study selection

published results, 141 articles were screened based on their abstracts and titles. Of the 35 screened articles whose full text were searched, only 33 full texts were retrieved while 2 articles were further excluded because we couldn't retrieve their full texts. A further 27 records were excluded upon full-text screening, as 25 were not in the study area and one was a case report [15].

Hence, only six studies were included in the final analysis. All included articles were published in the last three years (2022 & 2024) [16–21]. One was a prospective study and the remainder were all retrospective in design. All studies were conducted in Mogadishu city, the capital, and the most populated area (see Table 1).

3.1 Patients, demographics, prevalence, and surgical management

Of the six articles included in our study, 14,612 patient records were reviewed for urinary stone disease prevalence, patient demographics, radiological stone characteristics, and urinary stone management. The mean age of the patients was 34.6 (ranging between 0.2 to 102 years old). Of the total 14,612 patients, 2,612 patients were reported to have urinary stone disease. Males were predominantly affected compared to females with 65.7% and 34.3%, respectively. Adults (≥ 18 years old) accounted for 87.9% of the patients while 12.1% were children. Only three studies reported urolithiasis prevalence which ranged between 8.1% and 17% [16–18].

Table 1 Characteristics of the included studies

Author name	Publication year	Study design	Study site	Total patients	Urolithiasis patients n (%)	Mean age (years)
S. Cimen	2022	Retrospective	Mogadishu	3680	620 (17)	47.5
Asir Eraslan	2022	Retrospective	Mogadishu	2806	227 (8.1)	12.7
Ebubekir Arslan	2022	Retrospective	Mogadishu	435	276 (63.4)	34.7
S. Cimen	2023	Retrospective	Mogadishu	204	204 (100)	36.3
NI Dirie	2023	Retrospective	Mogadishu	7276	1075 (14.8)	45.6
A Hilowle	2024	Prospective	Mogadishu	210	210 (100)	31.1
Overall	2022—2024	–	–	14,611	2,612	34.65

Table 2 Study demographics, urolithiasis characteristics, and surgical management (2612 urolithiasis cases)

Author name	Adults > 18, n (%)	Pediatric < 18, n (%)	Male/female (%)	Imaging NCCT n (%)	Renal stone, n (%)	Single/ multiple stones n (%)	No. of staghorn calculi n (%)	Mean stone size (mm)	Hydronephrosis n (%)	Surgical management		
										Open lithotomy n (%)	PCNL/URS n (%)	RIRSn (%)
S. Cimen	620 (100)	0 (0)	77.4/22.6	371 (59.9)	223 (36)	NA	10 (4.5)	22.4	270 (43.5)	285 (45.9)	95 (15.3) / 82 (13.2)	67 (10.8)
Asir Eraslan	0 (0)	227 (100)	55.9/44.1	180 (79.2)	115 (50.7)	NA	18 (8)	16.15	189 (83.2)	104 (45.8)	31 (14) / 40 (18)	30 (13.2)
Ebubekir Arslan	276 (63.4)	0 (0)	71.3/28.7	262 (60.2)	77 (28)	237 (86) / 39 (14)	NA	5.9	224 (81)	NA	NA	NA
S. Cimen	194 (95.1)	10 (4.9)	67.6 / 32.4	119 (58.3)	204 (100)	106 (52) / 98 (48)	64 (31.4)	NA	NA	NA	NA	NA
NI Dirie	996 (14.9)	79 (12.8)	65.3 / 34.7	1,075 (100)	613 (57)	745 (69.3) / 330 (30.7)	88 (8.2)	13.2	655 (60.9)	NA	NA	NA
A Hilowle	210 (100)	0 (0)	56.7/43.3	210 (100)	210	190 (90.5) / 20 (9.5)	0	13.0	102 (48.6)	0	108 (SMP) / 0	102
Overall	2,296 (87.9)	316 (12.1)	65.7/34.3	2,217 (84.9)	1,442 (60)	1,278 (72.4) / 487 (27.6)	180 (14.6)	14.13 (SD: 5.96)	1,440 (60.3)	389 (45.9)	234 (22.1) / 122 (14.4)	199 (18.8)

The choice of imaging modality for the stone diagnoses was predominantly non-contrast computer tomography (NCCT) scan and was used in 85% of the cases, while the rest were diagnosed using sonographic imaging. Renal stone (nephrolithiasis) was found to be the most diagnosed condition and was reported for up to 60% of the patients. Of the 1,442 nephrolithiasis cases, 180 (14.6%) were staghorn calculi. Looking at all urolithiasis cases, 72.4% had a single stone while 27.6% had multiple stones. The mean stone size was 14.13 mm (± 5.96). Similarly, hydronephrosis was reported in 60.3% of all patients.

Three of the six studies reported data regarding urinary stone disease management [17, 18, 21]. These covers 1,057 patients whose conditions were managed using four different surgical procedures. The majority of the patients, 389 (36.8%), underwent open lithotomy. Percutaneous nephrolithotomy (PCNL) was performed in 234 (22.1%) of cases, out of which 126 (11.9%) underwent standard PCNL and 108 (10.2%) supermini PCNL (SMP). Ureteroscopic pneumatic surgery (URS) and retrograde intrarenal surgery (RIRS) were performed in 122 (11.5%) and 199 (18%) cases, respectively (see Table 2).

4 Discussion

Over the past decades, Somalia has been dealing with long-term conflicts, recurrent droughts, famine, and recently the effects of global warming [22]. The healthcare system is overwhelmed with managing one crisis after another. Priorities for the allocation of the limited resources included communicable diseases and sexual and reproductive health. Non-communicable diseases such as urolithiasis are therefore neglected. Urolithiasis is a major global health problem in many countries and regions around the world [3]. Recent studies have shown that Somalia has a high prevalence of stone disease compared to the neighboring countries of Ethiopia and the countries in the East Africa Community (EAC) [7, 9, 16, 23]. Dirie et al. reported a 14.8% urolithiasis prevalence in a study of more than seven thousand patients who underwent NCCT in Mogadishu [16]. The prevalence in Somalia based on the current review ranges between 8–17%.

The results of the analysis reveal that males are more likely to be affected than females (65.7% vs. 34.3%, respectively), which is in keeping with reports worldwide [6]. Potential causes of this gender disparity ranged from lifestyle risk factors (men tend to consume a high-protein diet and drink less water) and differences in urine chemistry [24]. However, current available data indicate that this trend is gradually changing with adolescent females showing increased risk [24, 25]. This review also found that the majority of the patients (85%) underwent NCCT to confirm the diagnosis, which is the gold standard for detecting urinary stones and is the recommended best practice by the European Association of Urology (EAU) on urolithiasis [26]. NCCT has more than 97% sensitivity for identifying urinary stones compared to sonography with 75% sensitivity and only 16.7% specificity [27]. Nephrolithiasis is the most commonly diagnosed condition (60%) compared to stones in other urinary organs [10] and is associated with a higher risk of serious complications. These findings suggest that Somalia's private and public health sectors should invest more in the techniques and equipment needed for the management of upper urinary stones. Fortunately, procedures such as PCNL, URS, and RIRS using a Holmium laser or pneumatic lithotripter are available in some centers in Mogadishu [17, 18, 21]. However, these facilities are far from meeting the needs of the entire population given the reported prevalence.

More than 87% of those affected were adults in this review and 12% were children (< 18 years). In health-facility-based studies using NCCT, Dirie et al. and Asir et al. reported the prevalence of urolithiasis in children to be 12.8% and 8.1%, respectively [16, 18]. Pediatric urolithiasis is a unique disorder as most affected children have a high tendency of stone formation due to various underlying causes, some known as stone formers [28]. Many of these children require extensive metabolic investigations to find the exact cause of the stone formation. Vieira and colleagues reported that 95% of the children with urolithiasis they assessed had metabolic abnormalities [29]. Recommendations from an EAU members' survey and expert panel discussion in 2022 were to perform stone and metabolic analysis in 83% and 63%, respectively [30]. Unfortunately, such facilities are currently unavailable or inadequate at best in Somalia. Furthermore, pediatric urolithiasis management requires specialized smaller scopes, adding more financial burden to health centers and the need for special expertise. In the same study by the EAU experts, they recommended using standard PCNL for stones > 20 mm while also recommending the use of miniaturized PCNL procedures for the children. In Somalia, Asir et al. used standard PCNL in 14% of their cases, RIRS in 13.2%, and open lithotomy in the majority (> 45%) of their pediatric patients [18].

Obstructive stones are associated with more complications such as recurrent infections and may lead to renal impairment if not treated adequately [31]. More than 60% of the cases in our study had some degree of hydronephrosis, making interventions necessary to preserve renal function. Lee et al. showed that the longer the duration of obstruction due to the impacted stone, the higher the probability of estimated glomerular filtration rate (eGFR) reduction to > 50%, with further risk of worsening renal function when associated with acute pyelonephritis

[31]. In our review, multiple stones and staghorn calculi were found in 28% and 15% of patients, respectively, both of which present more complex surgical challenges. For instance, PCNL procedures will require more than one tract to remove the stones in different calyces of the kidney. A meta-analysis of ten studies with more than 1800 patients comparing single-tract percutaneous nephrolithotomy (STPCNL) and multiple-tract percutaneous nephrolithotomy (MTPCNL) showed that STPCNL has significantly lower hemoglobin decrease, fewer pulmonary complications, and fewer blood transfusions [32].

Several factors including age, stone location, stone size, symptomatic or asymptomatic, obstructive or non-obstructive, and the organ involved are considered when managing urinary stone disease. Stones bigger than 20 mm in the kidneys will require standard PCNL or open lithotomy [26]. The mean stone size in this study was 14.1 mm, making miniaturized PCNL and RIRS the most appropriate surgical choices. In keeping with this, both Asir et al. and Hilowle et al. reported utilizing supermini PCNL (SMP) and RIRS for the management of urolithiasis for Somali patients in their centers [18, 21]. In Africa and many parts of the developing world, getting access to centers equipped with endourological machines with skilled surgeons is a big challenge. A recent study of 46 centers in 27 African countries found that only 33/46 (72%) had access to CT scans while 34/46 (74%) had operative theaters with endourological facilities [13]. In the same study, the centers mainly used rigid ureteroscopy, and only 7/30 (23.3%) had the possibility of performing rigid ureteroscopy, flexible ureteroscopy, and percutaneous nephrolithotomy [13]. Similarly, despite the desirable features of ESWL including its non-invasiveness, low morbidity, and usability in patients that are not fit for open surgery, its usage is largely limited because it is not cost-effective to both the patients and the health center administrating the procedure in resource-limited settings [33]. Although urolithiasis is a major health burden in many parts of Africa, there is limited availability of advanced endourological equipment for better management of stones disease.

The limitations of this study include that there was no study outside of the capital Mogadishu. In addition, all data were either hospital or diagnostic center-based, no community-based studies have been conducted to evaluate the true disease incidence and prevalence in the population. Furthermore, none of the studies assessed the stone composition since urinary stone composition is crucial for medical or surgical management. The nearest location to Somalia with reports of urolithiasis stone composition is Nairobi, Kenya, where the researchers found that all stones contained calcium and oxalate [8]. All except one of the studies in this review were retrospective in design. There was also limited long-term follow-up of the patients.

In conclusion, we found that Somalia has one of the highest urolithiasis prevalence reported in the region with 8.1–17%. Males are predominantly affected by the disease while urolithiasis increases with the age of the patients. Fortunately, according to our findings, there are several advanced surgical procedures provided in Mogadishu hospitals and urological clinics. More studies focusing on urolithiasis stone compositions, demographics within the country, and clinical data are required.

Abbreviations

ASIR	Age-standardized incidence rate
DALYs	Disability-adjusted life years
EAC	East Africa community
EGFR	Estimated glomerular filtration rate
EAU	European Association of Urology
ESWL	Extracorporeal shock wave lithotripsy
GBD	Global Burden of Disease
MTPCNL	Multiple-tract percutaneous nephrolithotomy
NCCT	Non-contrast computer tomography
PCNL	Percutaneous nephrolithotomy
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
RIRS	Retrograde intrarenal surgeries
STPCNL	Single-tract percutaneous nephrolithotomy
SD	Standard deviation
SMP	Supermini PCNL
URS	Ureteroscopic pneumatic surgery

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Author contributions
N.I.D: study design, manuscript writing; J.H: manuscript editing; A.O.H: study conceptualization; B.G: study design, manuscript drafting; methodology; H.A.A: manuscript drafting; F. A.H.O: data search; A.K.M: data extraction and organization; M.H.A; research conceptualization; J.H.M: manuscript editing; M.M.A: data extraction and organization; M.A. Sh: final editing, manuscript drafting.

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Declarations

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Consent for publication
We agree for publication.

Competing interests
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