African Urology 2026;6:15-20
https://doi.org/10.36303/AUJ.0239

AFRICAN UROLOGY
ISSN 2710-2750 EISSN 2710-2750

ORIGINAL RESEARCH

Management of urinary tract stones in Ghana: a national review and practice audit

JE Mensah,[1] R Ofosu-Akromah[2]

[1] *Department of Surgery, University of Ghana Medical School, Korle-Bu Teaching Hospital, Ghana*
[2] *Komfo Anokye Teaching Hospital, Ghana*

Corresponding author, email: jemensah@ug.edu.gh

Background: Urinary stone disease (USD), defined as the formation of hard mineral and salt deposits (stones) within the urinary tract, remains a growing concern in Ghana, reflecting both traditional risk factors and emerging lifestyle changes. In response, the Ghana Association of Urological Surgeons (GAUS) conducted a national review of practice patterns to assess the progress in adopting modern treatment modalities and identify persistent challenges.

Methods: A retrospective survey was carried out across urological centres in Ghana from January to December 2023. Data were collected using a standardised template that captured patient demographics, stone location, and treatment modalities. The findings were analysed and compared with global trends, particularly regarding economic and infrastructural contexts.

Results: A total of 268 cases were reported from five of the six teaching hospitals and four private hospitals in the country (66.4% male, mean age 46.3 years). Upper urinary tract stones (kidney, ureter, renal pelvis) accounted for 232 cases, 99.6% of which were treated using endoscopic or non-invasive methods. These included ureteroscopy (URS) with laser fragmentation (91 cases), percutaneous nephrolithotomy (PCNL, 61 cases), extracorporeal shock wave lithotripsy (ESWL, 30 cases), double J (DJ) stenting (seven cases), and medical expulsive therapy (MET, 42 cases). Only one open pyelolithotomy was recorded. Conversely, 77.8% of lower urinary tract stones (32 bladder, four urethral) were managed by open surgery, reflecting the frequent need to simultaneously address underlying pathologies, such as benign prostatic hyperplasia (BPH) or strictures.

Discussion: Ghana's endourological capability for upper urinary tract stone management has reached global standards, with the absence of open ureteric procedures highlighting effective skill distribution and inter-facility referrals. However, lower tract stone management remains surgically invasive due to anatomical, logistical, and economic realities. Key systemic challenges include equipment maintenance costs, reliance on external vendors, and limitations in biomedical engineering support.

Conclusion: Ghana has achieved significant milestones in modern urological care for USD, especially in the upper urinary tract. Addressing the remaining gaps, particularly in equipment sustainability and minimally invasive access for lower tract stones, requires a coordinated policy and investment framework.

Keywords: urolithiasis, urinary stone disease, endourology, Ghana, surgical audit

Introduction

USD, also known as urolithiasis or nephrolithiasis, is one of the most prevalent urological conditions globally, imposing a substantial burden on healthcare systems and individual well-being. The incidence and prevalence of this condition are consistently reported to be increasing worldwide, affecting approximately 1–15% of the population.[1,2] Its variations depend on regional and demographic factors, with notable differences in prevalence, presentation, and management approaches across various socio-economic regions.[1,2] Ghana, with a population of approximately 33 million, has a reported prevalence of upper urinary tract stone disease estimated at 2 per 100 000.[3] However, data on the broader burden of urolithiasis in sub-Saharan Africa remain limited.

A recent systematic review and meta-analysis of 26 studies across the continent reported a pooled prevalence of 9.4% among hospital-attending patients, with kidney stones being the most common (4.6%), followed by bladder (2.0%), ureteric (1.8%), and urethral stones (0.2%).[4] While high-income countries (HIC) have experienced a plateau or decline in age-standardised incidence rates over recent decades, low- and middle-income countries (LMIC) continue to report rising prevalence rates, driven by evolving risk factor profiles that combine traditional infectious and nutritional causes with emerging lifestyle-related factors.[5,6]

In sub-Saharan Africa, including Ghana, the epidemiological landscape of USD reflects this dual burden. Traditional risk factors, such as endemic infections, malnutrition, and delayed healthcare presentation, remain prevalent, while urbanisation and dietary transitions have introduced new challenges, including obesity, metabolic disorders, and sedentary lifestyles.[1,7,8] This complex interplay has created unique management challenges that differ substantially from those encountered in developed healthcare systems.

Historically, urological stone management in Ghana predominantly relied on open surgical techniques due to limited access to advanced endourological equipment and specialised training.[9] However, the past decade has seen significant developments in the country's urological infrastructure. The establishment of specialised urology centres, increased investment in modern equipment, and the expansion of training programmes have facilitated the gradual

adoption of minimally invasive procedures, including URS, PCNL, and ESWL.[10-12]

Despite these advances, comprehensive data on current stone management practices across Ghana remain limited. Most existing literature focuses on single-centre experiences or case series, lacking the breadth necessary to inform national healthcare policies and resource-allocation decisions.[11,12] This knowledge gap is particularly significant given the substantial resource implications of different treatment modalities and the need for evidence-based planning in resource-constrained settings.

The GAUS acknowledged this critical need for national-level data when organising their 2024 annual general meeting under the theme "Urinary stone disease in Ghana: contemporary management and challenges." A nationwide data collection initiative was launched, inviting all practicing urologists to contribute anonymised case data on stone location, patient demographics, and management approaches from the previous year.

This research addresses a critical knowledge gap as Ghana and other LMICs navigate the transition from traditional open surgical approaches to modern minimally invasive techniques. By documenting real-world practice patterns, this study aims to provide essential baseline data for healthcare planners, policymakers, and clinical leaders working to optimise urological care delivery in resource-limited settings. The methodology employed may offer a replicable framework for similar national audits in other developing countries facing comparable challenges in urological service provision.

Patients and methods

The GAUS conducted a nationwide retrospective survey to capture current trends in the management of urinary tract stones across public and private hospitals in Ghana. Data were collected over 12 months, from January to December 2023, using a standardised template distributed to all active urology centres.

Participating centres submitted de-identified aggregate data on all patients treated for urinary tract stones during the study period. The information collected included patient demographics (sex and age), stone location (kidney, ureter, bladder, or urethra), and the type of treatment administered (medical, endoscopic, open surgical, or shockwave therapy). Both paediatric and adult cases were included.

To simplify analysis, stone locations were grouped into upper urinary tract (kidney, renal pelvis, ureter) and lower urinary tract (bladder, urethra). Treatments were categorised as minimally invasive (URS, PCNL, ESWL, stenting, litholapaxy) or open surgery. MET was considered a non-surgical, conservative approach.

The data were collated, cleaned, and analysed centrally. Frequency distributions were used to describe treatment patterns across anatomical regions. Findings were discussed at the GAUS's 2024 annual general meeting. Global comparisons were drawn using peer-reviewed literature and guideline recommendations from the American Urological Association (AUA), European Association of Urology (EAU), and regional LMIC studies.

Ethics

Ethical approval was not required as no patient identifiers were collected, and the analysis was based solely on anonymised, institutional-level data.

Results

A total of 268 USD cases were reported from urology centres across Ghana in 2023. Data were submitted by five of the six teaching hospitals and four private hospitals in the country. The male-to-female ratio was approximately 2:1, with 178 males (66.4%) and 90 females (33.6%). The age distribution was broad, ranging from under 10 years to 90 years (Figure 1). The mean age of patients was 46.3 years. The most common age group affected was 31–40 years (53 cases), followed by 41–50 years (50 cases), and 21–30 years (47 cases). Fifteen children aged ≤ 10 years were treated, indicating that paediatric urolithiasis, while less frequent, is also a component of the national burden.

Upper urinary tract stones (kidney, renal pelvis, ureter)

There were 232 cases involving the upper urinary tract: 91 kidney stones, 34 renal pelvic stones, and 107 ureteric stones. Of these, 231 cases (99.6%) were managed with minimally invasive or non-

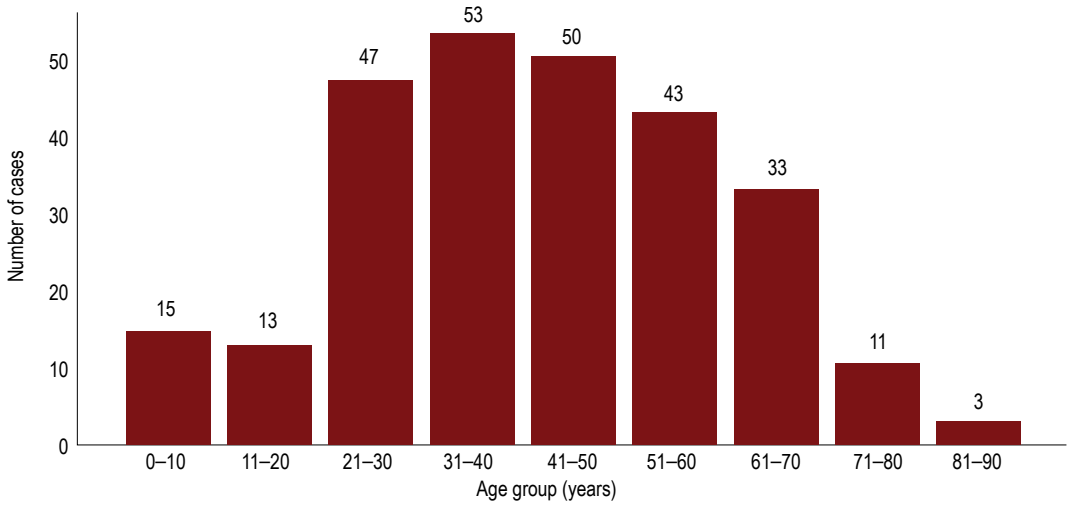

Figure 1: Age distribution of urinary stone cases in Ghana in 2023

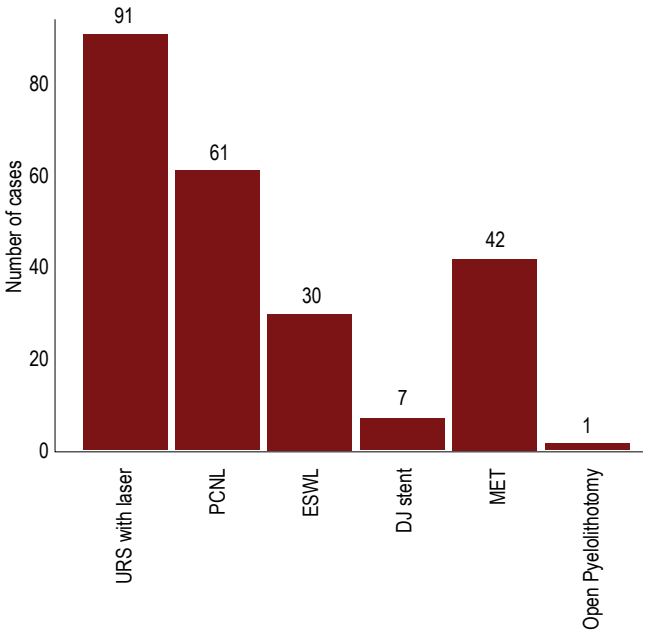

Figure 2: Treatment modalities for upper urinary tract stones in 232 cases
DJ – double J, ESWL – extracorporeal shock wave lithotripsy, MET – medical expulsive therapy, PCNL – percutaneous nephrolithotomy, URS – ureteroscopy

open procedures, including URS with laser fragmentation and stenting (91 cases), PCNL (61 cases), ESWL (30 cases), DJ stent insertion (seven cases, as interim management or adjunct), and MET (42 cases) Only one case required open pyelolithotomy, and no open ureterolithotomy was reported (Figure 2). These results show a near-complete transition from open to minimally invasive surgery for upper tract stones across the surveyed centres.

Lower urinary tract stones (bladder, urethra)

A total of 36 cases involved the lower urinary tract: 32 bladder stones and four urethral stones. Open cystolithotomy was performed in 28 cases (77.8%). Minimally invasive procedures included: cystolitholapaxy (four cases) and urethral endoscopic stone removal (four cases) (Figure 3).

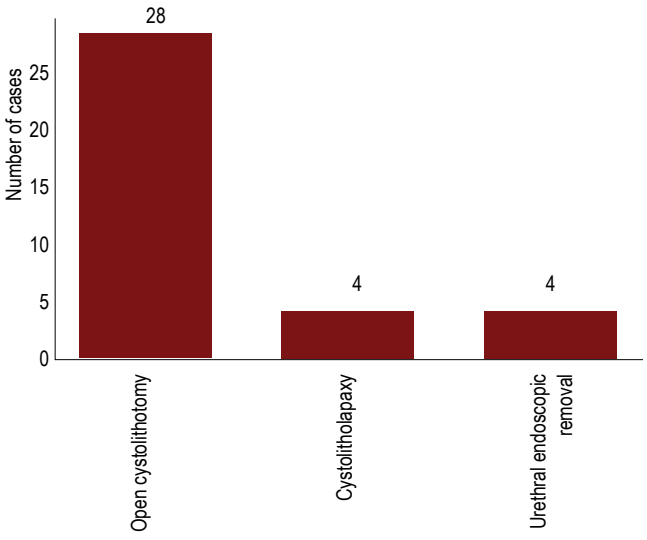

Figure 3: Treatment modalities for lower urinary tract stones in 36 cases

Discussion

The data revealed a male-to-female ratio of approximately 2:1 (178 males and 90 females out of 268 cases). This pattern is consistent with previous studies from Kumasi and the 37 Military Hospital, and aligns with global figures, where men constitute around 67% of cases.[11-13] The age distribution showed that the most affected age group was 30–49 years, slightly younger than the global peak, which typically occurs between 50 and 70 years.[5] This earlier presentation in Ghana may reflect evolving dietary patterns, dehydration due to high temperatures, and increasing metabolic risk factors among the working-age population.[1]

Anatomically, upper urinary tract stones accounted for the vast majority of cases (232/268, 86.6%), with the kidney and ureter being the predominant sites. Lower urinary tract stones, though fewer in number (36 cases), had a notable feature: 32 were bladder stones, representing approximately 11.94% of all cases. This proportion is more than double the global average of 5% and is characteristic of LMICs, where bladder stones often arise from bladder outlet obstruction (BOO) due to BPH, prostate cancer, or urethral stricture, and may be compounded by nutritional deficiencies.[13-16] In contrast, stone disease in HICs tends to be more metabolically driven.[17] This epidemiological profile underscores the dual burden of both infectious and metabolic contributors to stone formation in Ghana and highlights the importance of context-specific strategies for prevention and management.

Ghana's management of upper urinary tract stones in 2023 reflects an advanced stage of transition toward endourological techniques. Only one patient underwent an open pyelolithotomy, and no open ureterolithotomies were reported. The absence of any open ureterolithotomy cases suggests that centres without in-house endourological facilities refer patients to centres where these techniques are available. This shift is comparable to the standards seen in HICs, where open surgery is generally reserved for anatomically complex or failed endoscopic cases.[17]

The expansion of PCNL capabilities is particularly noteworthy. Sixty-one cases were managed using PCNL, indicating that the country has the requisite equipment, training, and postoperative care protocols required for this technically demanding procedure.[8,11] In HICs, PCNL remains the gold standard for large renal stones, and its effective adoption in Ghana suggests that local urologists can perform the full range of modern stone surgeries.

The dominance of URS with laser fragmentation in the management of ureteric stones (91 cases) highlights the growing reliance on advanced energy sources, such as the holmium laser. This mirrors international guidelines, which recommend URS as the first-line treatment for ureteric stones larger than 10 mm.[17] The pattern observed in Ghana demonstrates that local practice has evolved to match these recommendations. Although flexible ureteroscopes are the preferred choice for proximal ureteric stones worldwide, their high cost and maintenance requirements limit their availability in most Ghanaian centres.

Detailed data on definitive treatment following DJ stent insertion were not captured in this dataset. Semi-rigid ureteroscopes are widely utilised, even for proximal ureteric stones. DJ stenting before definitive treatment helps dilate and "paralyse" the ureter, enabling safer and more effective URS. This means that many patients undergo a staged approach to treatment, with initial DJ stenting followed by definitive URS.[8] While this is a rational and cost-effective adaptation in resource-limited settings, it introduces delays in treatment and increased costs to patients.

Extracorporeal shock wave lithotripsy (ESWL)

ESWL was used in 30 cases, and while it is less commonly employed than URS or PCNL, its availability at multiple centres is a positive development.[12] ESWL remains an attractive non-invasive option for selected cases of renal and proximal ureteral stones. However, its effectiveness depends on factors such as stone size, composition, and localisation, as well as the quality of imaging and lithotripter calibration. Continued expansion of ESWL availability in Ghana will require investment in operator training and infrastructure maintenance.

Medical expulsive therapy (MET)

Beyond surgical interventions, MET plays an important role in the conservative management of ureteric stones, particularly distally located stones measuring 5–10 mm in diameter. In these cases, there is a reasonable likelihood of spontaneous passage, especially with pharmacological facilitation. Alpha blockers, such as tamsulosin, are commonly used to relax ureteral smooth muscle and enhance stone expulsion.[18] Clinical data suggest that smaller stones (< 2 mm) may pass spontaneously within approximately eight days, while stones measuring 4–6 mm may require up to 22 days. However, this approach is typically not recommended beyond six weeks, due to the increased risk of complications, such as infection, obstruction, or renal impairment.[19,20]

In the Ghanaian context, MET was reported in 42 cases, indicating moderate uptake of this approach. Despite its inclusion in global guidelines and its pharmacological feasibility, the broader application of MET faces systemic limitations. Although tamsulosin is listed under the National Health Insurance (NHI) scheme for treating BPH, it is not reimbursed when used for USD. This reflects a critical policy gap in the NHI benefit package, where USD management is not adequately supported despite its growing burden. Consequently, patients often pay out of pocket for medications that would otherwise be funded in similar clinical settings worldwide.

Addressing this policy gap could expand the conservative management options available to both patients and clinicians, reduce the surgical burden, and optimise resource allocation within the health system. Inclusion of stone-related indications for alpha blockers, like tamsulosin, in the NHI scheme formulary would represent a practical step toward aligning medical coverage with clinical need and evidence-based practice.[21]

Lower urinary tract stones: persistent reliance on open surgery

In contrast to the upper tract, management of lower urinary tract stones in Ghana remains heavily reliant on open surgical procedures. Of the 36 bladder and urethral stone cases, 28 (77.8%) were treated with open cystolithotomy. Minimally invasive alternatives, such as cystolitholapaxy and endoscopic urethral stone removal, were employed in only four cases each. This reliance on open surgery for bladder stones is not unexpected and reflects the complex aetiological profile of these stones in Ghana.

In LMICs, bladder stones are often secondary to BOO from BPH, prostate cancer, or urethral stricture.[17,22] In such cases, open surgery provides the opportunity to address both the stone and the underlying pathology through concurrent prostatectomy or urethroplasty. This approach is not only practical but often more cost-effective in settings where endoscopic instruments are limited and patients may be unable to afford staged procedures.[23]

Paediatric urolithiasis

Although paediatric cases accounted for only 15/268 patients (5.6%), their presence is a reminder that USD affects all age groups. Paediatric urolithiasis in LMICs often has unique aetiologies, including malnutrition, infections, and congenital anomalies.[24,25] In Ghana, dietary factors, such as low calcium intake and high oxalate consumption, compounded by limited hydration, may play a role.[26] There is a need for targeted public health strategies and paediatric-focused research to better characterise and manage this subgroup.

Comparison with global practices

The pattern of upper tract stone management in Ghana now closely mirrors that of HICs, where URS, PCNL, and ESWL are the standard of care.[17] The absence of open ureterolithotomy across all centres is a clear indicator of this alignment. Conversely, reliance on open cystolithotomy for lower tract stones reflects practices seen in LMICs across Asia and Africa. Global literature supports this observation. In countries like India, Egypt, and Nigeria, open cystolithotomy remains common due to the high prevalence of BOO and the practicality of combining stone removal with definitive management of the underlying pathology.[22,4] In contrast, countries with robust health insurance systems and widespread access to endoscopic equipment, such as the United States, United Kingdom, and Japan, report very low rates of open bladder surgery.[22,27]

Health system barriers: equipment and maintenance challenges

The high initial cost and ongoing maintenance requirements of endourological equipment remain significant barriers. Holmium lasers, ureteroscopes, and PCNL systems require regular servicing, calibration, and replacement of consumables, such as laser fibres and guidewires.[28] In Ghana, many of these services are outsourced to external vendors, often at considerable cost. Furthermore, the newer generations of laser fibres are embedded with chips to limit reuse, further increasing costs. This challenge is compounded by a lack of trained biomedical engineers capable of performing diagnostics and repairs locally. Many donated or purchased

machines eventually become non-functional due to the absence of preventive maintenance and readily available spare parts.[28]

Strategies for system strengthening

To address the equipment-related challenges, several strategies are recommended:

1. Training programmes for biomedical engineers. Develop local capacity for diagnostics and maintenance of urological equipment.[29]
2. Strategic vendor partnerships. Establish long-term contracts with one or two vendors to standardise equipment, negotiate better pricing, and incentivise local training.
3. Regulatory advocacy. Work with regulatory bodies to discourage chipping of laser fibres and advocate for increased reusability, especially in low-income settings.
4. Pooled procurement and maintenance contracts. Adopt regional procurement models to negotiate lower prices and coordinated service contracts for high-volume consumables and maintenance.

Study limitations

This study relied on retrospective, self-reported institutional data submitted by participating urology centres across Ghana. Therefore, variations in data completeness, stone location classification, and treatment coding may have introduced reporting bias. The dataset also lacked detailed clinical variables, such as stone size, composition, imaging findings, and long-term outcomes, which limited more granular analysis of treatment effectiveness and recurrence rates. Additionally, although efforts were made to include all centres, some small facilities did not submit data. Despite these limitations, the data provide a robust national overview and form a valuable baseline for future prospective and registry-based studies.

Conclusion

The 2023 national data on USD management in Ghana presents a clear narrative of progress and persisting gaps. The strong uptake of minimally invasive surgery for upper tract stones represents a national success story enabled by strategic investments and professional training. Nevertheless, the continued reliance on open surgery for lower urinary tract stones underscores the structural, economic, and aetiological realities unique to Ghana and other LMICs.

Conflict of interest

The authors declare no conflict of interest.

Funding sources

No funding source to be declared. The study sponsors had no role in the study design, data collection, analysis, interpretation, manuscript writing, or decision to submit for publication.

Ethical approval

Ethical approval was not required as no patient identifiers were collected, and the analysis was based solely on anonymised, institutional-level data.

ORCID

JE Mensah https://orcid.org/0000-0003-4133-1722

R Ofosu-Akromah https://orcid.org/0000-0003-1415-795X

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