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Research Article

Epidemiology of Upper Tract Urolithiasis and ESWL Treatment in Kumasi, Ghana

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Abstract:

Background: The incidence of upper tract urolithiasis is rising worldwide and treatment options have improved to include extracorporeal shock-wave lithotripsy (ESWL), percutaneous nephrolitothomy (PCNL) and ureterorenoscopy (URS) but sub-Saharan Africa has lagged behind the rest of the world. Open stone surgery was the main surgical treatment for upper tract stones in Kumasi until the introduction of ESWL five years ago. This study was conducted to evaluate ESWL in the management of upper tract urolithiasis in Kumasi, Ghana.

Materials and methods: We prospectively analyzed all patients treated for upper tract urolithiasis at the Bomso Specialist Hospital in Kumasi from January 1, 2014 to December 31, 2017. Patients with upper tract stone of 2cm or less underwent ESWL. Data obtained on patient demographics, stone characteristics and outcome of ESWL was analyzed with PASW Statistics for Windows, Version 18.0. Chicago: SPSS Inc.

Results: There were 170 patients with upper tract urinary stones over the study period with a male: female ratio of 2:1. The mean age was 46.5 years. Inadequate fluid intake (<3L/day) was the most common predisposing factor seen in 45.3% of the patients. The commonest symptom was flank pain seen in 134 (78.8%) patients. There were 149 (87.6%) patients with solitary stones, mostly in the kidney 115 (67.6%). A total of 142 (83.5%) patients underwent ESWL with successful stone clearance in 120(84.5%) patients. The most common complication of ESWL was flank pain 36 (25.4%).

Conclusions: ESWL is effective for treatment of upper tract urolithiasis and should be made accessible to patients when indicated in the sub-region..

Key Words: urolithiasis, urinary tract, calculi, shock wave lithotripsy

Introduction:

Urolithiasis has gained increasing significance due to its rising incidence worldwide and also because of its tendency to recur [1]. It occurs as a result of the influence of epidemiological, biochemical, metabolic, genetic and environmental risk factors [2].

Upper urinary tract calculi usually occur in developed countries due to high calcium and protein consumption whilst lower urinary tract calculi usually occur in developing countries [3,4].

However, the incidence of upper tract urolithiasis is increasing in tropical Africa [5-7]. In Ghana, the incidence of upper urinary tract urolithiasis has been reported as 2 per 100, 000 people [8].

The treatment for urolithiasis is influenced by the size of the stone, number of stones, its location and the age of the patient [9]. The treatment options have improved over the past four decades to include extracorporeal shock-wave lithotripsy (ESWL), percutaneous nephrolitothomy (PCNL) and ureterorenoscopy (URS). However, whilst the western world has rapidly adopted these minimally invasive endourological techniques and ESWL, sub- Saharan Africa has lagged behind [10,11]. Open stone surgery was the main surgical treatment for upper tract stones in Kumasi until the introduction of ESWL about five years ago. This study was conducted to evaluate the presentation and outcome of ESWL in the management of upper tract urolithiasis in Kumasi, Ghana.

Materials and Methods:

We prospectively analyzed all patients treated for upper tract urolithiasis at the Bomso Specialist Hospital in Kumasi from January 1, 2014, to December 31, 2017. All patients with upper tract urolithiasis treated during this study period were included in the study. All patients had radiologically confirmed stone disease; by ultrasonography or computerized tomography (CT) scan. Patients with renal calculi of 2cm or less underwent ESWL. Those patients with ureteral stones < 5mm were managed conservatively with alpha- adrenergic blockers whilst those with ureteral stones >5mm but < 2cm underwent ESWL. Patients with ureteral stones > 2cm were referred for ureteroscopy and laser lithotripsy. ESWL was done under sedation using an MJ-ESWL- 108C lithotripter

machine (Zhanjiang Shi Meijian Medical Apparatus Co, Ltd. China) under ultrasound guidance. Hence, only patients with stones visible on ultrasound were offered ESWL. The working voltage was 6~8KV and the number of impacts was 800 to 2000 times, with an average of 1400 times. The lithotripsy sessions were performed by a radiology technician under the supervision of the urologist. Relevant data obtained included the demographic details, clinical presentations, characteristics of the stone (size, location, number of stones), the number of lithotripsy sessions, the result of the treatment and complications of the ESWL. Stone clearance was confirmed by computer tomography (CT) scan or ultrasound scan done within three months after the last lithotripsy session. Treatment success for kidney stones was defined as the absence of residual fragment or an asymptomatic residual fragment of less than 4mm and for ureteral stones as the total absence of residual fragment. All the patients had biochemical analysis of their serum and urinalysis as part of the work up for urolithiasis. Data was analyzed with PASW Statistics for Windows, Version 18.0. Chicago: SPSS Inc. Ethical clearance for the study was obtained from the Committee on Human Research Publication and Ethics of the Kwame Nkrumah University of Science and Technology.

Results:

One hundred and seventy (170) patients with upper tract urinary stones were seen over the study period. There were 113 (66.5%) males and 57 (33.5%) females giving a male: female ratio of 2:1. The mean age was 46.5 years with a standard deviation of 14 years. There was a family history of urolithiasis in 6(3.5%) patients and 14 (8.2%) patients had a history of recurrent urinary tract infection (UTI). Four (2.4%) patients had gout and the majority 77 (45.3%) had inadequate fluid intake as a predisposing factor for urolithiasis, as shown in Table 1. One hundred and fifty four (90.6%) patients presented with symptoms of urolithiasis whilst almost 10% of patients had asymptomatic disease which was found incidentally on ultrasound scan. The commonest symptom was flank pain, seen in 134 (78.8%) patients followed by colicky abdominal pain in 18 (10.6%) patients. Five of the patients with flank pain also had macroscopic hematuria on presentation.

There were 149(87.6%) patients with solitary stones. Most solitary stones were in the kidney 115 (67.6%) followed by stones in the renal pelvis 10(5.9%) and mid ureter 10(5.9%) respectively. As shown in Table 2, the majority (63.1%) of solitary stones were less than 1cm in size with 29.5% between 1cm-2cm whilst 7.4% were >2cm in size

There were 21 (12.4%) patients with multiple stones which were mostly found in the kidney and pelvi-ureteric junction (PUJ) 11(6.5%), or kidney and proximal ureter 7(4.1%) as shown in Table 1.

A total of 142(83.5%) patients underwent ESWL. Twenty eight (16.5%) of the patients were not offered ESWL. This included 11(6.5%) patients whose stones were not visible on ultrasound, 13 (7.6%) patients with stones > 2.0cm or high stone burden and 4(2.4%) patients with ureteral stones of 5mm or less for whom conservative management until spontaneous stone clearance was successful. ESWL was successful for stone clearance in 120 (84.5%) patients, 72(50.7%) of whom required two to three sessions for stone clearance. There was no correlation between the number of ESWL sessions and the size of the kidney stones ($p = 0.18$). However, there was a correlation between the number of ESWL sessions and the size of ureteral stones ($p = 0.006$). Twenty two (15.5%) patients had residual stone after ESWL treatment. This included 12 patients with multiple calculi, 3 patients with lower pole renal calculi of 1-2cm and two patients each with 1-2cm renal calculi in upper and mid poles respectively. These patients were referred for further management. There were also 3 patients with ureteric calculi > 1cm who were referred for URS. The complications of ESWL were flank pain 36 (25.4%), bruises on the flank 32 (22.5%), hematuria 29(20.4%), renal hematoma 9(6.3%) and straining to void 6 (4.2%) and one patient with steinstrasse.

Table 1: Clinical features of Patients

Chronic Disease	Present No (%)
Diabetes	15 (8.8)
Hypertension	30(17.6)
Gout	4(2.4)
Sickle Cell	2(1.2)
Family history of stone disease.	6(3.5)
UTI	14(8.2)
Daily Water Consumption	
Daily water consumption < 3 litres	97(57.1)
Daily water consumption > 3 litres	73 (42.9)
Symptoms (n= 154)	**Present No (%)**
Hematuria	5(2.9)
Flank pain	134(78.8)
Colicky abdominal pain	18(10.6)
Diffuse, non-colicky abdominal pain	2(1.2)
Location (solitary stones) n= 149	**Present No (%)**
Stone in kidney	115(67.6)
Stone in renal pelvis	10(5.8)
Stone in PUJ	2(1.2)
Stone in proximal ureter	8(4.8)
Stone in mid ureter	10(5.8)
Stone in distal ureter	4(2.4)
Location (multiple stones) n=21	
Stones in kidney	2 (1.2%)
Stones in kidney and PUJ	11(6.5%)
Stones in kidney and proximal ureter	7(4.1%)
Stones at PUJ and mid ureter	1(0.59%)

Table 2. Size and location of solitary stones

Location of stone	Size of calculus			Total Number of patients
	< 1cm	1cm-2cm	>2cm	

Upper pole of kidney	38	15	4	57
Mid pole of kidney	24	13	2	39
Lower pole of kidney	10	6	3	19
Renal pelvis	6	3	1	10
Pelviureteric junction	2	0	0	2
Proximal ureter	4	3	1	8
Mid ureter	7	3	0	10
Distal ureter	3	1	0	4
Total Number	94	44	11	

Discussion:

The use of shock waves in the treatment of urinary stones was first introduced in humans in Germany in 1982 [12]. Since then, ESWL has spread worldwide and improved the management of upper urinary tract lithiasis [12,13]. The management of urinary calculus disease in Ghana is still developing as all the modern facilities such as PCNL or URS available are only in a few centres in the capital city, Accra. In Kumasi, ESWL is the only form of lithotripsy currently available.

The finding in this study of 170 patients with urinary calculus disease in Kumasi over the four year study period compares with the 178 patients found in Nairobi over a 5.5 year period [11]. It clearly indicates the rising incidence of urinary calculus disease in Ghana when compared with the 51 patients seen in Accra thirty years ago over an 8 year period [8]. This increasing incidence has also been observed in Nigeria [14]. This may be due to improved socioeconomic conditions over time, and the subsequent changes in dietary habits [15].

The study found a mean age of 46.5 years with a male to female ratio of 2: 1. This is comparable to the 40.1 years and 2:1 male to female ratio observed in Accra by Kluffio et al 30 years ago[8]. This suggests that despite evidence that the male to female ratio of upper tract urolithiasis is narrowing since the 1980s in the United States, the trend has not changed in Ghana [16].

The most common predisposing factor for urolithiasis observed in this study was inadequate (<3.0L/ day) daily fluid intake, found in 97 (57.1%) patients. Fluid intake is inversely related to the risk of incident kidney stone formation [17]. There is controversy regarding the role of the type/ hardness of drinking water to stone formation. Although some studies suggest that calcium quantity of tap water may cause hypercalciuria and hypooxaluria, Mohammad and colleagues in 2011, showed that biochemical urinary stone composition is independent of the type of drinking water [18-20]. Hence, this study looked at the quantity of daily fluid intake as estimated by the patient but not the type of drinking water.

Six (3.5%) patients in this study had a family history of urolithiasis. A familial occurrence for hypercalciuria, one of the main risk factors for idiopathic urolithiasis has been reported [21]. There is also an autosomal recessive inheritance for cystinuria and primary hyperoxaluria [22,23]. However, familial recurrence of urolithiasis may not necessarily be due to an inherited transmission, but the effect of environmental factors shared by family members, especially those related to dietary habits [24]. In their study, Curhan et al. found that only about 60% of the enhanced risk of stone formation among relatives of patients with idiopathic urolithiasis might be related to genetic inheritance [25]. Goldfarb and colleagues had similar findings in a study to examine genetic and non-genetic factors associated with urolithiasis [26]. We are unable to determine whether the patients with positive family history in this study had genetic inheritance, common environmental risk factors or both.

The majority (87.6%) of patients in this study had solitary stones, similar to previous findings in Accra [8]. However, renal stones predominated in this study in contrast to the findings in Accra and also in Dakar where ureteral stones were more common [8, 27].

ESWL is non - invasive, has low potential for major complications and is effective for most upper tract urinary calculi [28]. The success rates of ESWL range between 85 - 93% [28, 29]. This is comparable to the 84.5 % ESWL success rate in this study although the majority (50.7%) required two to three sessions for stone clearance. The need for repeated sessions in the majority of patients undergoing ESWL is a significant limitation to ESWL [30].

Hematuria occurring post ESWL is usually minimal and resolves spontaneously [31] Thirty- two patients in this study had hematuria post ESWL but it resolved spontaneously within 72 hours. Thirty Six patients had a colic attack post ESWL. This usually results from the migration of stone fragments. Some authors recommend routine prescription of pharmacological agents such as alpha- adrenergic blockers or even pre-ESWL ureteral stenting to facilitate the migration of stone fragments [32, 33]. All patients in this series were put on Tamsulosin post ESWL until complete stone clearance.

Conclusion:

The management of upper tract urolithiasis in Kumasi is still evolving towards the standard approaches of stone treatment. Intracorporeal lithotripsy is currently unavailable but ESWL is available for selected patients as an effective means of treatment with acceptable complication rates as shown in this study.

Declarations of interest:

None.

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Abbreviations:

ESWL- extracorporeal shockwave lithotripsy
PCNL- percutaneous nephrolithotomy
URS- ureterorenoscopy