African Journal of Emergency Medicine 12 (2022) 358–361

Contents lists available at ScienceDirect

African Journal of Emergency Medicine

journal homepage: www.elsevier.com/locate/afjem

ORIGINAL ARTICLE

Evaluation, management, and analysis of demographic and radiological characteristics of patients with renal colic at a tertiary hospital in Somalia

Ebubekir Arslan*, Abdikarim H Mohamed

Mogadishu Somalia Turkish Training and Research Hospital, Mogadishu, Somalia

ARTICLE INFO

Keywords:
Renal colic
Emergency centre
Urolithiasis

ABSTRACT

Background: Renal colic is a common emergency centre (EC) complaint worldwide, but its epidemiology and strategies for evaluation and treatment have been little reported in Africa. To the best of our knowledge, this is the first study aimed at evaluating the radiological investigations, management, and analysis of demographic characteristics of patients with urinary system stones who visited the EC.

Method: A 3-year retrospective study of a total of 435 patients with acute renal colic who underwent radiologic investigations was included in this study. The overall positive stone rate, stone location, size, and hydronephrosis grade were assessed. The sensitivity and specificity of ultrasound were evaluated using patients with both an ultrasound and a non-contrast CT (NCCT).

Results: The mean age of the patients was 34.7years; males accounted for 71.3% (n = 310), while females were 28.7% (n = 125). Urolithiasis was found in 63.4% of the cases, 71.3% of males and 28.7% of the females had a stone diagnosis (P < 0001). There was no statistically significant association between age and stone diagnosis (P > 0.05). The sensitivity and specificity of USG were 86.1% and 94%, respectively. Seventy-two percent of the cases had ureteral stones (29% in proximal, 25% in UVJ, 9% in mid, and 9% in distal ureter), followed by 28% having renal stones (19% calyces and 9% in renal pelvis). The mean size of the stone was 5.9±1.8, half of the cases harbour stone size <5mm, followed by 30% in 5mm-1cm.

Conclusion: Due to the scarcity of well-equipped tertiary care hospitals and the low socioeconomic status of the patients living in Sub-Saharan Africa, Ultrasound can be the initial investigation of choice because it is safe, cheap, and may help guide diagnosis and the need for further imaging. However, NCCT remains the gold standard diagnosis of choice for acute flank pain.

Introduction

Acute flank pain due to renal colic is one of the most severe pain patterns that has a significant burden and is a common presentation to the emergency room worldwide [1]. Renal colic affects about 12% of the population, resulting in 1.2 million persons seeking health facilities annually. Renal colic pain is multifactorial, with blockage of urine flow leading to an increase in intrarenal and intraureteral pressure with resultant ureteral smooth muscle contraction [2]. Sudden-onset flank pain, nausea, and vomiting followed by radiating pain are the most common manifestations of patients with renal colic in the emergency centre.

Urolithiasis is a common condition in western and non-western countries, with prevalence rates ranging from 7 to 13% in North America, 5–9% in Europe, and 1–5% in Asia. Stone prevalence and incidence vary with age, peaking in 40-60years of life, with low incidence in children and the elderly, with male predominance in prevalence and incidence in a 2:1 ratio compared with females [3].

In evaluating suspected acute renal colic patients, NCCT remains the gold standard diagnosis of choice. It increases the sensitivity for detecting urolithiasis, including radiolucent stones, and the benefit of identifying other aetiologies mimicking renal colic. It also provides detailed information to improve the diagnosis and management of suspected renal colic [4]. Non-contrast CT has a high sensitivity (95-97%) and specificity (96-100%) for the detection of urinary tract calculi with a high negative predictive value [5].

Due to the scarcity of well-equipped tertiary care hospitals and the low socioeconomic status of the patients living in Sub-Saharan Africa, Ultrasound can be the initial investigation of choice because it is safe, cheap, and may help guide diagnosis and the need for further imaging. Notably, it is a good option in paediatric and pregnant patients with the advantage of being non-invasive, and has no exposure to radiation, albeit it is operator-dependent [6]. Ultrasound is also a reasonable investigation of choice in young female patients with flank pain as most young females have a low positive stone rate compared to male patients [7]. Several studies reported that ultrasound alone had a better sensitivity of about 73.5%, 92.7% specificity, and 74.5% of a negative predictive value for detecting urolithiasis. In comparison, some other studies reported a low sensitivity rate of about 53% [8, 9]. Based on the reported

* Corresponding author at.
E-mail address: ebuarslan@hotmail.com (E. Arslan).

https://doi.org/10.1016/j.afjem.2022.07.011
Received 13 November 2021; Received in revised form 22 June 2022; Accepted 24 July 2022

studies in the literature, the initial radiological investigation of choice remains controversial.

To date, there have been no studies regarding epidemiologic and radiological findings of renal colic in the emergency centre reported from Somalia, and this is the first study aimed to investigate the radiological evaluation, management, and analysis of demographic characteristics of patients with urinary system stone disease who visited the emergency centre.

Methods

A total of 435 patients with acute renal colic who have received the diagnostic code of urolithiasis (N20-23) in agreement with the International Classification of Diseases (ICD-10) system that underwent radiologic investigations either ultrasound (US) and non-contrast computed tomography KUB (NCCT) were retrospectively reviewed between 2018-2020 using their electronic medical records in the hospital information system (HIS). The primary outcome measure was the epidemiology of urolithiasis in acute renal colic patients. The secondary outcome measure was prioritizing the radiological modalities. The emergency physicians followed a standard protocol for evaluating these patients. These patients underwent ultrasound as the initial diagnostic modality to detect hydronephrosis, which was confirmed with non-contrast CT KUB. Paediatric patients, pregnant women, patients needing intravenous contrast, and those lacking or missing radiologic imaging were excluded from the study.

Age along with gender, clinical and radiological reports were recorded. The multidetector unenhanced CT KUB protocol was the standard conventional CT scan, and the results were reviewed using Picture archiving and communication system (PACS) imaging technology. Axial (with 1 mm cross-section), coronal and sagittal planes NCCT were used to determine stone size and localization. Stone location was documented as ureter (upper ureter stone, mid, distal ureter, and ureterovesical junction) and renal (calyces and renal pelvis). For comparative analysis, the stone size was divided into <5mm, 5-10mm, 11-20mm, 21-30mm, and >30mm.

The sensitivity and specificity for ultrasound were evaluated using those patients who had both the US and a CT ($n = 262$), which was based on direct visualization of stone on ultrasound and the suspected presence of stone based on indirect USG findings (hydronephrosis). The anteroposterior diameter of the renal pelvis and the Society of Fetal Urology (SFU) staging system was used to determine and grade the presence of hydronephrosis [10].

Furthermore, data collected include the type of management (conservative, surgery) and the indication of surgery in patients planned for intervention (1. emergency operation for bilateral ureteral obstruction or a functional or structural solitary kidney, 2. patients with treatment failure after medical expulsive therapy, and 3. patients having larger stone size).

The ethical committee of our institution received the ethics approval form (REF. MSTH-). Patients gave their informed consent.

The data were analysed using descriptive and inferential metrics. For categorical variables, the frequencies and percentages were reported as point estimates. Quantitative variables, the mean ± (SD), were used whenever possible. Bivariate analyses were used to determine the relationship between variables. A p-value of <0.05 was considered statistically significant. The Statistical Package for Social Sciences (SPSS -IBM) for Windows version 23 was used for all statistical analyses.

Results

A total of 435 patients with renal colic that underwent radiologic investigations were included in the study. The mean age of the patients was 36.7years old. The age group between 19-39-years was the most predominant (66.4%), followed by 40-59-years (22.7%), and >60years in about 10.8%. Regarding gender distribution of the patients, males were more than two-thirds of the study population and accounted for 71.3% ($n = 310$) of the total cases, while females were 28.7% ($n = 125$). Most patients (90.5%) had an initial ultrasound, and a conformational non-contrast abdominal CT was performed for 60.2%. Urolithiasis was found in 63.4% of the cases, 71.3% of males and 28.7% of the females had a stone diagnosis ($P < 0001$). There was no statistically significant association between age and stone diagnosis ($P > 0.05$).

Regarding the characteristics of urolithiasis, 72% of the cases had ureteral stones (29% in proximal, 25% in UVJ, 9% in mid, and 9% in distal ureter), followed by 28% having renal stones. The mean size of the stone was 5.9±1.8, varying from millimetric stones to complex staghorn stones. Half of the cases harbour stone size <5mm, followed by 30% in 5mm-1cm in size. Eighty-six percent of the cases had unilateral stones, while 14% of the cases were bilateral. 5% of the stone cases were solitary kidneys. 33%, 36%, 8%, 4% of the cases had grade 1, 2, 3, 4 hydronephrosis, while 19% had no hydronephrosis (Table 1).

The sensitivity and specificity of USG were 86.1% and 94%, respectively. We found that ultrasound has a high positive rate for ureteral stone detection in 79% of the cases, although detection of ureteral stones less than 5mm in size was 70%. Ultrasound revealed a false negative in stone locations for ureterovesical junction [19], 14 in distal ureteral stone, six in the mid ureter, and three in the upper ureter.

Sixty-three percent of the cases were managed conservatively (analgesics and medical expulsive therapy), while 37% of the patients underwent surgery. Regarding surgery indications, 32% of the patients were emergency, 33% were treatment failure, and the remaining 35% needed definitive management due to larger stone size. Surgical interventions were more in patients with larger stone sizes.

Discussion

This study identifies an area that is of interest, especially in Somalia and the rest of Africa. Renal colic is a common EC complaint worldwide-but, its epidemiology and strategies for evaluation and treatment have been little reported in Africa. The prevalence of urolithiasis has increased in developed and low-income countries over several decades [11]. The hot climate and water scarcity have increased the occurrence of urolithiasis in Sub-Saharan African countries. To date, there have been no studies regarding epidemiologic and radiological findings of renal colic in the EC reported from Somalia. This is the first study to investigate the radiological evaluation, management, and analysis of demographic characteristics of patients with urinary system stone disease who visited the EC. In our study, urolithiasis was found in 63.4% of the cases. A systematic review, multispecialty, evidence-based consensus in line with the American College of Emergency Physicians (ACEP) regarding imaging in renal colic suggests that ultrasound may provide adequate diagnostic information to guide initial treatment. The ACR recommends that CT is “usually appropriate” and ultrasound “may be appropriate” for diagnosing acute flank pain [12]. The European Association of Urologists (EAU) recommends non-contrast computed tomography (NCCT) as the initial radiologic modality for acute flank pain. Nonetheless, if available, the EAU recommends ultrasound to be used initially; because it is safe, inexpensive, and radiation-free [13].

In evaluating suspected acute renal colic patients, NCCT remains the gold standard diagnostic modality (stone protocol). NCCT has a high sensitivity (95-97%) and specificity (96-100%) for detecting urinary tract calculi with a high negative predictive value [14]. A large study from U.S. emergency centres comprising 830,785 adult patients with newly diagnosed nephrolithiasis over 8-years declared that the use of ultrasound as the initial imaging of suspected renal colic increased from 2.7% to 6.9%. At the same time, the CT remained stable at 85.8% [15]. Recently Osmangazi University STONE score was introduced that composes four parameters (nausea, stone history, creatinine, and haematuria), with a total score of 9, with a cut-off value of >3, indicating the need for computerized tomography imaging. It is a beneficial and sim-

Table 1
Characteristics of urolithiasis patients.

Variables	No. of the patients	Percentage %
Urolithiasis		
Yes	276	63.4%
No	159	36.6%
Stone location		
Ureter	199	72%
Proximal	80	29%
Mid	25	9%
Distal	25	9%
Ureterovesical	69	25%
Renal	77	28%
Calyces	52	19%
Renal pelvis	25	9%
Stone size		
<5mm	141	51%
5-10mm	83	30%
11-20mm	36	13%
21-30mm	8	3%
>30mm	8	3%
Number of stones		
Single	237	86%
Multiple	39	14%
Hydronephrosis grade		
No	52	19%
Grade 1	92	33%
Grade 2	99	36%
Grade 3	22	8%
Grade 4	11	4%

ple tool in the ER to reduce unnecessary CT in renal colic patients. It also lowers health-related costs and ionizing radiation exposure [16].

Ultrasound is a non-invasive, non-expensive, and reproducible imaging technique, achieving accurate diagnosis in most cases without the need for radiation, and should be considered the primary imaging technique in patients with suspected renal colic. Regarding the sensitivity and specificity of ultrasound for the detection of urolithiasis; our study reported a higher sensitivity and specificity rate of about

86.1% and 94%, respectively, based on direct visualization of stone on ultrasound and the suspected presence of calculi based on indirect USG findings (hydronephrosis). A study by Riddell J et al. reported a similar overall positive rate of ultrasound [17]. Ultrasound alone had a better sensitivity of about 73.5%, 92.7% specificity, and 74.5% of the negative predictive value, as reported by Thungkatikajonkit P et al. [8]. Roberson NP and associates reported 69 paediatric ureteral stones comparing ultrasound versus computed tomography to detect ureteral stones and concluded that USG has a low sensitivity of about 53% [9]. Due to the scarcity of well-equipped tertiary care hospitals and the low socioeconomic status of the patients living in SSA, Ultrasound can be the initial investigation of choice because it is safe and cheap. It can determine calculi in the renal collecting system and document hydronephrosis [18].

Female patients are at the highest risk for developing solid cancer from exposure to ionizing radiation [19]. Ultrasound investigation for flank pain may be relevant to minimize radiation risk. The presence of urolithiasis in females was low compared to male patients at about 28.7%, which agrees with most of the reported studies in the literature [7]. Young female cases presenting with flank pain pose a particular diagnostic challenge. Likewise, the significant percentage of negative investigations in females suggests a possibility for revision in the current criteria for using CT KUB [19].

The limitations of our study include that it is a single-centre retrospective study. Further large, randomized studies are required to determine the accuracy of ultrasound regarding the evaluation of renal colic.

Dissemination of results

Results from this study were presented to provincial authorities and have been informally shared with clinical staff at the data collection site.

Conclusion

Due to the scarcity of well-equipped tertiary care hospitals and the low socioeconomic status of the patients living in Sub-Saharan Africa, Ultrasound can be the initial investigation of choice because it is safe, cheap, and may help guide diagnosis and the need for further imaging. However, NCCT remains the gold standard diagnostic modality for acute flank pain. In our study, urolithiasis was found in 63.4% of the cases; females have a lower stone rate than males at about 28.7%. Young female cases presenting with flank pain pose a particular diagnostic challenge. Likewise, the significant percentage of negative investigations in females suggests a possibility for revision in the current criteria for using CT KUB.

Authors contributed as follow to the conception or design of the work; the acquisition, analysis, or interpretation of data for the work; and drafting the work or revising it critically for important intellectual content: EA contributed 50%; and AHM 50%. All authors approved the version to be published and agreed to be accountable for all aspects of the work.

Declaration of competing Interest

The authors declare no conflict of interest associated with this publication.

References

[1] Turney B, Keoghane S. Variability of imaging modalities for acute flank pain in the UK. Bull R Coll Surg Engl 2013;95(5):1–3.
[2] Motov S, Drapkin J, Butt M, Monfort R, Likourezos A, Marshall J. Pain management of renal colic in the emergency department with intravenous lidocaine. Am J Emerg Med 2018;36(10):1862–4. doi:10.1016/j.ajem.2018.07.021.
[3] Sorokin I, Mamoulakis C, Miyazawa K, Rodgers A, Talati J, Lotan Y. Epidemiology of stone disease across the world. World J Urol 2017;35(9):1301–20.
[4] Patatas K, Panditaratne N, Wah TM, Weston MJ, Irving HC. Emergency department imaging protocol for suspected acute renal colic: Re-evaluating our service. Br J Radiol 2022;85(1016):1118–22.
[5] McLaughlin PD, Murphy KP, Hayes SA, Carey K, Sammon J, Crush L, et al. Non–contrast CT at comparable dose to an abdominal radiograph in patients with acute renal colic; impact of iterative reconstruction on image quality and diagnostic performance. Insights Imaging 2014;5(2):217–30.
[6] Patatas K. Does the protocol for suspected renal colic lead to unnecessary radiation exposure of young female patients? Emerg Med J 2010;27(5):389–90.

[7] Kennish SJ, Bhatnagar P, Wah TM, Bush S, Irving HC. Is the KUB radiograph redundant for investigating acute ureteric colic in the non-contrast enhanced computed tomography era? Clin Radiol 2008;63(10):1131–5.
[8] Thungkatikajonkit P, Wongwaisayawan S, Wibulpolprasert A, Viseshsindh W, Kaewlai R. Is combined ultrasound with radiography sufficient for the diagnosis of obstructive ureteric stone in patients with acute flank pain? J Med Ultrasound 2020;28(2):86–91.
[9] Roberson NP, Dillman JR, Reddy PO, DeFoor W, Trout AT. Ultrasound versus computed tomography for the detection of ureteral calculi in the pediatric population: a clinical effectiveness study. Abdominal Radiol 2019;44(5):1858–66.
[10] Fernbach 1 S K, Maizels M, Conway J J. Ultrasound grading of hydronephrosis: introduction to the system used by the Society for Fetal Urology. Pediatr Radiol 1993;23(6):478–80. doi:10.1007/BF02012459.
[11] Kim SG, Jo IJ, Kim T, Hwang SY, Park JH, Shin TG, Sim MS, Cha WC, Yoon H. Usefulness of protocolized point-of-care ultrasonography for patients with acute renal colic who visited emergency department: a randomized controlled study. Medicina 2019;55(11):717.
[12] Moore CL, Carpenter CR, Heilbrun ME, Klauer K, Krambeck AC, Moreno C, Remer EM, Scales C, Shaw MM, Sternberg KM. Imaging in suspected renal colic: systematic review of the literature and multispecialty consensus. J Amer Coll Radiol 2019;16(9):1132–43.
[13] Hughes T, Ho HC, Pietropaolo A, Somani BK. Guideline of guidelines for kidney and bladder stones. Turk J Urol 2020;46(Suppl 1):S104.
[14] Lei B, Harfouch N, Scheiner J, Demissie S, Hayim M. Can obstructive urolithiasis be safely excluded on contrast CT? A retrospective analysis of contrast-enhanced and noncontrast CT. Am J Emerg Med 2021;47:70–3. doi:10.1016/j.ajem.2021.03.059.
[15] Chang HC, Raskolnikov D, Dai JC, Holt SK, Sorensen MD, Sternberg K, Harper JD. National imaging trends in nephrolithiasis—does renal ultrasound in the emergency department pave the way for computerized tomography?. In: Urol Pract, 8; 2021. p. 82–7.
[16] Baseskioglu B, Ozakin E, Dolgun H, Arslan E, Acar N, Bilgin M, Colak E. Osmangazi University score to reduce ionizing radiation in renal colic patients in emergency department. Hong Kong J Emerg Med 2018;25(4):185–9.
[17] Riddell J, Case A, Wopat R, Beckham S, Lucas M, McClung CD, et al. Sensitivity of emergency bedside ultrasound to detect hydronephrosis in patients with computed tomography-proven stones. West J Emerg Med 2014;15(1):96–100.
[18] Cassell III A, Jalloh M, Ndoye M, Mbodji M, Gaye O, Thiam NM, Diallo A, Labou I, Niang L, Gueye S. Surgical management of urolithiasis of the upper tract–current trend of endourology in Africa. Res Rep Urol 2020;12:225.
[19] Keoghane S, Austin T, Coode-Bate J, Deverill S, Drake T, Sanpera-Iglesias J, Johnston T. The diagnostic yield of computed tomography in the management of acute flank pain and the emergency intervention rate for a proven acute ureteric stone. Ann R Coll Surgeons Engl 2018;100(8):598–605.