
The Ability of Microscopic Hematuria to Predict the Presence of Urolithiasis in Patients with Acute Flank Pain: An Iraqi Experience

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ABSTRACT:

Background: Iraq is a country with high prevalence of urinary stones since the dawn of civilization. Flank pain is a common complaint encountered in emergency rooms and outpatients clinics in which diagnosis can overlap due to the poor localization of pain by the patient. There is an anecdotal belief that anyone with flank pain must have a 'kidney stone'. General urine examination (GUE) is the primary screening test done for almost all patients presenting with acute loin pain. The interpretation of the results of urinalysis is usually done by the requesting doctor, hence building a decision whether a urinary stone is present or not. The finding of microscopic hematuria largely contributes to this decision and may or may not preclude the need for further investigations to confirm or exclude the presence of urinary stones as a cause of pain.

Purpose: To test the ability of the microscopic hematuria in predicting the presence or absence of urolithiasis in patients presenting with acute flank pain using ultrasound, KUB, intravenous urogram (IVU) and to a less extent computerized tomography (CT) scan as gold standards.

Materials and Methods: A randomized prospective study was performed in the Urology Consult Clinic of Al-Karama Teaching Hospital on 64 patients presenting with acute loin pain between January 2008 and December 2009. Each patient had a urinalysis within few hours of onset of pain as primary screening test, to look for microscopic hematuria. To confirm or exclude presence of stones, all patients were subjected to ultrasonic examination in the radiology department; some patients have KUB in addition. In cases of uninformative results, IVU or CT scan study were done in the hospital or requested in an outside radiological unit of another hospital or a private clinic. The results were recorded and interpreted to test for a correlation of microscopic hematuria and presence of urinary stones. Each patient was managed according to his individual condition.

Results: Sensitivity and specificity of microscopic hematuria were 51.61% and 54.55% respectively. The positive predictive value and negative predictive value for hematuria as a predictor for stone disease was 63.64% and 38.71% respectively. Overall accuracy of microscopic hematuria was 51.56%.

Conclusion: Hematuria is not found to be a sensitive or a specific marker in predicting urinary stones for patients with acute flank pain in current urological practice. Initial diagnosis of renal or ureteric stones should be made by an accurate history and by the results of urinalysis for hematuria. IVU is still a key-role player in establishment of diagnosis especially, ureteric stones. CT scan is now being introduced as an accurate tool with unrivalled superiority.

Keywords: Urolithiasis, microscopic hematuria, acute loin pain, Iraq.

Introduction:

Stones affect 1-5% of adult populations in industrialized nations. In the United States, stone disease accounts for >400,000 hospitalizations annually¹.

Urinary stones are a commonly encountered medical and, particularly, urological problem in everyday practice. Most, if not all, of patients with stones seek medical advice for an acute condition as flank pain, gross hematuria, etc. Urolithiasis is the most common diagnosis for colicky flank pain presenting to an emergency department². Over the last few decades, there is a popular belief among Iraqi folks that anyone with flank pain anecdotally has a 'kidney stone'. This would drive more patients to attend emergency units or outpatients clinics for urological advice. In Iraq, general urine examination (GUE) is the primary screening test done for almost all patients presenting with acute loin pain. It is requested by junior as well as senior doctors working in emergency departments or out-patients clinics of all levels of hospitals from peripheral to tertiary teaching ones.

The interpretation of the results of GUE is usually done by the requesting doctor, and hence, building a decision of further management. Here comes a crucial step, based on GUE, to decide whether the patient has a stone or not; with or

without performing additional confirmatory tests as ultrasound scan (US), KUB, intravenous urogram (IVU), or CT scan. In the appropriate clinical setting, the presence of hematuria has been used to make a presumptive diagnosis of urolithiasis and may preclude performance of additional confirmatory tests^{3,4}, especially in those patients who have previously passed stones⁷.

Some authors have suggested that in the absence of hematuria further investigation for urolithiasis may not be warranted and other diagnoses should be pursued to explain the acute flank pain⁵. However, other confirmed the absence of microscopic hematuria in about 9-18% of such patients⁶. These challenging conclusions can have varying degrees of impact on urinary calculi diagnosis in urological practice.

On the other hand, what constitutes clinically significant hematuria remains a matter of debate⁷. Some investigators consider the presence of greater than 1 red blood cell (RBC) per high power field in the urine abnormal⁸, while others diagnose hematuria only in the presence of greater than 3 or 5 RBCs per high power field^{9,10}.

Bove et al. stated that to date there is no consensus on urine processing or a defined minimum at which a cell count will always be considered positive for hematuria⁷. The diagnostic

value of urinalysis (GUE), against the 'gold standard' radiological tests, has been the subject of many studies worldwide^{11,12,13}.

In our urological practice, the 'standard' test is currently the ultrasonic examination and/or KUB for primary confirmation or exclusion of stones, while intravenous urogram or CT is usually done later for those patients with ureteric obstruction or in uninformative US or KUB results.

Unenhanced helical CT has not yet been introduced as a first line confirmatory utility for diagnosing urinary calculi in our hospitals in spite of the fact that it has been proved worldwide to be superior to other radiological tests in identifying the presence, number and location of ureteral stones⁷ as well as many other abnormalities that result in acute flank pain^{14,15}.

The purpose of this study is to examine the ability of microscopic hematuria finding on GUE to determine the presence of urinary calculi in patients with acute flank pain attending the urology consult clinic; taking the currently available radiological tests in a tertiary teaching hospital (Al-Karama Teaching Hospital, Baghdad); as a 'reference standard'.

Patients and Methods:

This prospective study was performed in the Urology Consult Clinic of Al-Karama Teaching Hospital where all patients presenting with acute loin pain are encountered directly or referred from emergency department or other Consult Clinic specialties. It was done between January 2008 and December 2009. Out of 92 patients presenting with acute loin pain, only 64 patients fulfilled the inclusion criteria of the study.

Pediatric patients, patients who received extracorporeal shock wave lithotripsy (ESWL), patients with ureteric stents, and those with no GUE done within 8 hours, were excluded. Some patients were lost to follow-up after they have been referred for ultrasound (US), KUB, IVU or CT scan. GUE was performed during the working hours of the

consult clinic or within few hours of the onset of pain

Acute flank pain related to the urinary tract (renal colic) was defined as acute pain that begins in the area of the flank, courses laterally around the abdomen, and radiates to the groin and/or genitalia¹⁶. Microscopic hematuria was defined as presence of 3 or more red blood cells per high power field on urine microscopy according to American Urological Association guidelines and Best Practice Policy Recommendations¹⁷.

Each of all 64 patients had general urine examination (GUE), in the laboratory department of the hospital, for clinical evaluation and identification of microscopic hematuria.

To confirm or exclude presence of stones, all patients were subjected to ultrasonic examination in the radiology department; some patients have KUB in addition.

In cases of uninformative results, IVU or CT scan study were done in the hospital or requested in an outside radiological unit of another hospital or a private clinic. Stone passed and brought by the patient is also considered an evidence of stone diagnosis. Patients' data: age, sex, history of stone passage, GUE, and results of US, KUB, IVU or CT whether stones are found or not, stone number and position; were recorded and fed to a special PC database program for analysis.

Each patient was managed according to his individual condition. Management plans included: admission to emergency room or hospital, giving analgesia, IV fluids, antiemetics, antibiotics, cystoscopy with or without double J insertion, extracorporeal shock wave lithotripsy (ESWL), and on occasions open surgery.

The statistical tests used are: sensitivity, specificity, positive predictive value, negative predictive value, and accuracy. They are calculated for each patient to measure the validity of microscopic hematuria against the 'gold standard' investigations.

The following table shows the way of calculation of each one of the above statistical parameters¹⁸.

Table 1: Statistical tests used in the study and their relations

		Condition (Stone present) (As determined by 'gold standard')		
		Positive	Negative	
Micro-scopic hematuria on GUE	Positive	True Positive	False Positive	→ Positive predictive value = $\frac{\Sigma \text{ True Positive}}{\Sigma \text{ Test outcome Positive}}$
	Negative	True Negative	False Negative	→ Negative predictive value = $\frac{\Sigma \text{ True Negative}}{\Sigma \text{ Test outcome Negative}}$
		↓ $\frac{\Sigma \text{ True Positive}}{\Sigma \text{ Condition Positive}}$	↓ $\frac{\Sigma \text{ True Negative}}{\Sigma \text{ Condition Negative}}$	

True positive cases are those who have microscopic hematuria and found to have stones on gold standard, true negative cases are those with no microscopic hematuria and have no stones, while false positive cases are those with hematuria and with no stones. Likewise, false negative do not have hematuria but found to have stones.

Results:

Of the 64 patients included in our study, there were 44 males (68.75%) and 20 females (31.25%) with a ratio of 2.2:1. They have a mean age of 39.5 years and an average of 18-68 years. These results were in accordance with other studies but the

patients in this study were younger at time of presentation. Microscopic hematuria was found in 33 patients (51.56%).

Radiological tests used to confirm the presence of stones are shown in Table 2.

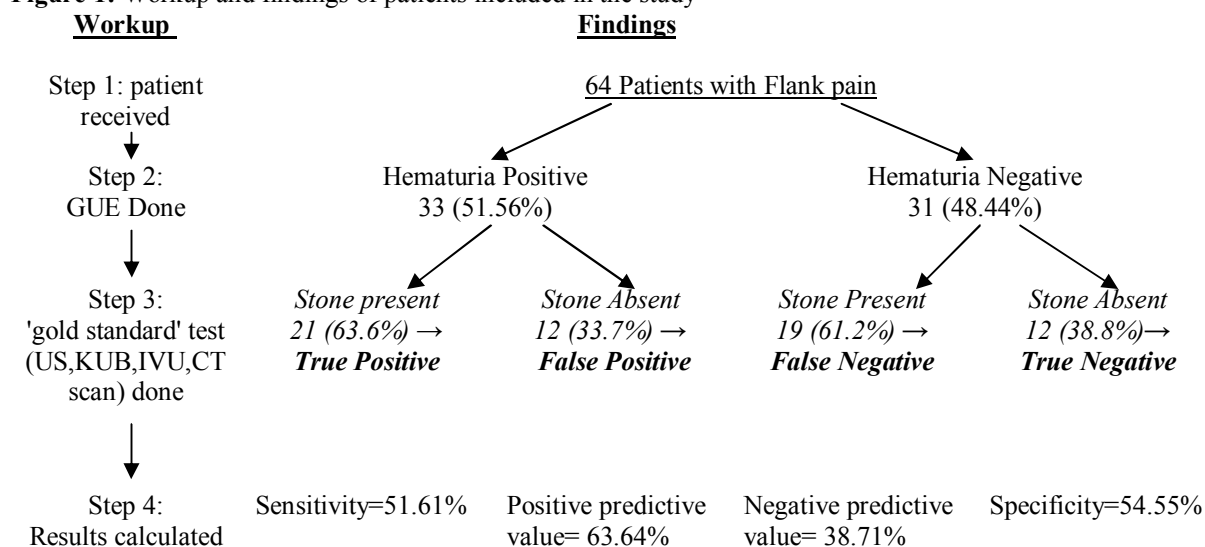
Out of these 33 patients, 21 (63.6%) had stones (true positive), whereas twelve (33.7%) had no stone (false positive). Thirty-one (48.44 %) patients did not have microscopic hematuria and out of these, 19 (61.2%) had stone (false negative) whereas no stone was present in 12 (38.8%) cases (true negative).

The overall workup and findings of all patients can be shown in the following diagram:

Table 2: 'Gold standard ' tests used for confirmation of stone presence:

Test	No. of patients	(%)
<i>Ultrasound (US)</i>	15	46
<i>KUB</i>	2	6
<i>IVU</i>	12	36
<i>CT scan</i>	4	12
<i>Total</i>	33	100

Figure 1: Workup and findings of patients included in the study



Sensitivity and specificity of microscopic hematuria were 51.61% and 54.55% respectively.

The positive predictive value and negative predictive value for hematuria as a predictor for stone disease was 63.64% and 38.71% respectively.

Overall accuracy of microscopic hematuria was 51.56%. Ureteric stones were detected in 17 (51.51%) patients with 6 of them had moderate hydroureteronephrosis (HUN).

Fifteen (46%) patients had more than one stone, ten (66.7%) of them had hematuria.

Discussion:

Iraq is a country with high prevalence of urinary stones since the dawn of civilization. Flank pain is a common complaint encountered in emergency rooms and outpatients clinics in which diagnosis can overlap due to the poor localization of pain and accurate self-expression by the patient. However, when a patient presents with acute flank pain, renal colic is a prime consideration in the differential diagnosis⁷.

Initial workup of these patients in our practice is controversial and tests requested are still at clinician discretion. Ultrasonic examination with or without

KUB are currently the primary tests requested by the doctors in urology outpatient clinics.

GUE can sometimes be requested only if the patient have lower urinary tract symptoms (LUTS).

Examination of urine for blood is a time-tested, simple and routine test in the evaluation of patients with flank pain as hematuria is thought to be present in most of the patients with urinary stones.

The presence of even a few erythrocytes in the urine is abnormal and requires further investigation¹⁹.

Some studies suggested that microscopic hematuria has a sensitivity of 100% as a marker of ureterolithiasis using IVU as a gold standard²⁰.

However, up to 15% of patients with a stone may not have hematuria at all²¹. Many studies dealing with the correlation of hematuria to urinary

calculous disease resulted in wide variability of challenging results by different authors with a sensitivity ranging from 53% to 100%, a specificity from 32% to 56%, and a positive predictive value of 64% to 84% and a negative predictive value of 31% to 100% using plain abdominal film, IVU, or unenhanced CT scan as gold standards. To date, no similar study has been performed in Iraq.

Although our results came close to most of the reported figures (Table 3), the message behind this study, in our opinion, is that it may draw the attention to the first step in managing patients with acute flank pain especially at patient's presentation. Interpretation of GUE can mislead the doctors, particularly the junior ones in emergency rooms, to adopt or exclude the diagnosis of urolithiasis on the expense of other causes of flank pain.

Table 3: Results compared to other studies.

Study Date	Authors	Sensitivity (%)	Specificity (%)	Positive predictive value (%)	Negative predictive value (%)
2011	Current study	52	55	64	39
2009	Mirza et al ¹³	54	56	76	32
2008	Xafis K et al ¹²	67	58	86	31
2002	Luchs et al ¹¹	84	48	72	65
1999	Boyd et al ²²	100	32	64	100

On the other hand, absence of microscopic hematuria may preclude the need for further investigations in search of urinary stones. Initial diagnosis should be made by eliciting an accurate history and by the results of urinalysis for hematuria²². Subsequent confirmation of the diagnosis should be made by intravenous urography or CT scan.

Ultrasound is still a reference standard in detecting renal stones with a consideration to unenhanced helical CT scan. Although CT is generally acknowledged as superior for evaluation of ureteral calculi, the difference between US and CT for evaluation of renal pelvis and parenchymal calculi has not been established².

With the recent advent of CT scan in our hospitals, the importance of IVU in detecting urinary stone may become less, but CT is still not accessible as a primary facility investigation in stone disease. However, IVU is now chosen as the next step done for patients found to have dilated pelvicalyceal systems (PCS) on ultrasound scan or in those with uninformative ultrasound results.

Conclusion:

Hematuria is not found to be a sensitive or a specific marker in predicting urinary stones for patients with acute flank pain in current study setting. It may not be relied upon in the primary workup of patients with renal colic but its absence should not exclude the diagnosis of urolithiasis and its presence may not divert the attention of the

clinician from other causes of acute flank pain. By all means, one should neither forget the stone nor the hematuria!

It is evident that a more refined selection of patients with acute flank pain taking the renal or ureteric colic as a basis of inclusion would greatly increase the sensitivity and specificity of microscopic hematuria as a predictor of urinary calculi. We highly recommend the use of CT scan in our hospitals for the primary workup of those patients as an investigation with unrivalled superiority.

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