

NORMAL ED ULTRASOUND PREDICTS LOW RISK RENAL COLIC PATIENTS FOR UROLOGICAL INTERVENTION WITHIN 90 DAYS.

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Abstract:-

Background: CT scan has emerged to be the investigation of choice for renal colic patients in the emergency setting. Ultrasound (US) provides an alternative modality with minimal radiation risk.

Objective: The purpose of this study is to determine the ability of US to identify renal colic patients who are at low risk for urological interventions within 90 days of their initial ED visit.

Methods: A retrospective cross sectional observational chart review study was conducted in a tertiary care hospital, Royal Hospital, Oman from Jan2009 to Feb2013 using the electronic medical records to extract the data by Trained abstractors.

Results: 302 patients were enrolled in the study. 92 (30 %) had normal US results while 210 (70 %) had abnormal US. Only 1.3 % of those with normal US results had CT in comparison to 13% with abnormal US. There were 51 (16%) patients who underwent urosurgical intervention within 90 days of ED visit. 1.7% from the normal ultrasound group whereas 15% from the abnormal ultrasound group P.value 0.001

Conclusion: A normal US results in low risk renal colic patient may predict low likelihood for urological intervention within 90 days from ED presentation.

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Keywords: renal colic, ultrasound, urolethiasis, urological intervention, CT-scan, emergency department.

INTRODUCTION:

Renal colic affects nearly 1.2 million people each year and accounts for approximately 1 percent of hospital admissions¹. Currently, widespread availability of CT scan and easy access made the use of CT-renal protocol is the diagnostic study of choice. However, the use of Emergency ultrasound is of similar efficacy. The new trend nowadays is to avoid the use of CT in renal colic patients in order to avoid radiation exposure .It is estimated that the risk of cancer from one CT imaging is 1/800 to 1/10000 according to the executed type of scan and the age of the patient². Catalano O et al.2002 and Worster A et al. 2002 both demonstrated that non helical CT was superior to IVP in diagnosing acute urolithiasis. The sensitivity of CT to detect stones ranges from 91%-100% with specificity ranging from 91% to 97%.Because of its high sensitivity & specificity, CT is considered to be the gold stranded for visualizing urinary calculi.^{4, 5} Although CT detected stones in 60% of the recruited patients as demonstrated in Kobayashi T et al study 2003 , most stones were small & likely to pass spontaneously.⁶ Nevertheless, CT shown to be useful in identifying alternate diagnosis, particularly in older patients.⁷ Several studies shown that patients with renal colic are likely to undergo CT on multiple occasions, resulting in potentially dangerous cumulative lifetime radiation exposure.^{8, 9, 10}. That is why overall there is increasing concern about patient radiation exposure from CT and usage of US has emerged as a new imaging tool for patients suspected to have urolithiasis. Estimated sensitivity of US to visualize ureteral calculi vary widely & are lower than that of CT (12-93%), but highly accurate in detecting hydronephrosis, perinephric fluid & abnormal urinary jets, which often indicate the presence of calculi with sensitivity nearing 100% .^{11, 12, 13, 14} On the other hand the results of Ultrasound imaging is readily obtainable (especially in areas with limited resources) with minimal radiation risk. Given these and the increasing concern about lifetime cumulative radiation exposure attributed to excessive use of CT, it seems imperative for EM physicians to use alternate imaging modalities whenever it is practical to do so.¹⁴Some studies demonstrated US specificity for direct & indirect findings compatible with ureterolithiasis is greater than 90%.US has been recognized as a useful imaging tool for patients in whom radiation exposure should be avoided.^{15, 16}. There were numerous studies which evaluated the ability of US to identify renal colic patients with low risk of requiring urological intervention after their initial ED visit. Marcia L Edmonds Et al has studied this retrospectively in multicampus academic tertiary care center in Ontario over 1 year period.² They concluded that a normal result on renal US predicts a low likelihood for urologic intervention within 90 days for adult ED patients with suspected urolithiasis. We believe that uroethiasis diseases pattern here in Oman is different (due to several suggested reasons e.g. Racial differences, hot climate and different ED setting) than in other parts of the world.³ Due to all those factors and the fact that such study has never been done in this part of the world, this study emerged as a retrospective cohort observational study aiming to evaluate US as an alternative tool for imaging patients presented with renal colic in our ED setting. The purpose of this study is to determine the ability of US to identify renal colic patients who are at low risk of urological interventions within 90 days of their initial ED visit.

Definitions:

Follow up: over all follow up including the need for further radiological imaging, further emergency visits and urological intervention (ESWL (extracorporeal shockwave lithotripsy), ureteric stents or cystoscopic extraction) within 90 days of first visit.

Combination group: those patients who were found to have visualized ureteric stone and indirect evidence suggestive of ureterolithiasis in ultrasound or CT.

Low risk patients: patients diagnosed to have simple ureteric/renal stones non obstructive with no infections process and without the need for any urological interventions.

Senior Radiologist: board certified radiologist.

Methodology:

We conducted a retrospective cross sectional observational study (prognostic)

- ✓ **Inclusion Criteria:** ALL adult ED patients (>=18 year, <50 year) who underwent ED ordered US for suspected renal colic
- ✓ **Exclusion Criteria:** patients <= 18 year or >=50 year, recurrent renal colic, previous CT done elsewhere, pregnancy.
- ✓ **Timing:** from 1/1/2009 to 30/2/2013 (almost 4 years)

Setting:

Royal Hospital is a tertiary care center in Oman with annual patient visits of 60000 patients .The process of doing US imaging for the suspected renal colic started partially on 2009 .Renal colic patients were getting US done for them within 3 days of their ED visit with reporting seen by ED physician. US is done and reported by senior radiologist. Ethical approval was obtained ahead before data collection from Royal Hospital Research Ethical committee.

Method of Recruitment:

Exposure/ Control: Those who fulfill the inclusion criteria and having diagnostic procedure of US were enrolled

Sample size: To obtain a study power of 80 % the estimated sample size was 290. We recruited total of 302 patients in our study.

Outcome measured:

- 1) Visualized ureteric stone
- 2) Indirect evidence suggestive of ureterolithiasis (hydronephrosis, perinephric fluid or non-obstructing stone)
- 3) Disease unrelated to urolithiasis
- 4) Need for repeat imaging
- 5) Further Emergency visits or urological intervention (including: ESWL (extracorporeal shockwave lithotripsy), ureteric stents or cystoscopic extraction)

Data extraction: Data was extracted from (ALSHEFA system) which is the electronic hospital system using the ED cases coded as renal colic (N20, calculus of kidney and ureter, N20.2 calculus of kidney with calculus of ureter) and underwent US. Before data abstraction, we clearly defined all study variables and developed a standardized data collection tool. Four abstractors completed the data extraction then double checked by randomly taking 10 patients records to determine the demographic characteristic, imaging results and need for urologic interventions to overcome any transcription error. All records were reviewed to determine if any patients had subsequent imaging, subsequent ED visits, hospital admission or urological procedure within 90 days of their initial ED visits.

Data management: Data were entered directly into a study specific Microsoft Excel database. Descriptive statistics were summarized using means, standard deviation (SD) and differences in proportion of patients requiring urologic procedure. All patients' personal information was dealt with in high confidentiality, with the data kept in multiple secured sites for high quality of data. SPSS 16.0 for windows was used for data management with Pearson Chi-Square calculations for the final results.

Results: There were 302 ED ordered renal US for suspected renal colic from 1/1/2009 to 30/2/2013. Demographic characteristics are summarized in Table 1. The mean age of all patients was 34 years and 202 (66.9%) out of them were male. Only 2 (0.66%) patients were brought to the emergency department by ambulance (1 was from the visualized renal stone patients, who did not need admission but needed follow up with CT and ESWL, the 2nd patient was from the normal US group and needed further imaging with CT). Overall 9 (3%) patients needed admission p value of 0.120. The mean length of stay in the ED was 2 hours.

Table 2 demonstrate the 302 ED ordered renal US for suspected urolithiasis with the subsequent need for CT and urological interventions. There were 92 (30%) patients categorized as normal with 4 (1.3%) of them needed subsequent CT within 90 days of their ED visit p 0.000, while 5 (1.7%) required urological interventions within those 90 days of follow up (p 0.000). Only one patient of them was identified to have renal stones (p 0.018).

In the group Of the 113 patients with abnormal US findings suggestive of urolithiasis, 34 (11%) needed subsequent CT (p 0.000) and 29 (85.3%) of them were found to have renal stones (p 0.018). While more than quarter of them 31 (10%) underwent urological interventions within 90 days of their visit (p 0.001).

In the group of visualized ureteric stones only 6 (2%) required CT imaging (p 0.000) and almost all of them were confirmed to have ureteric stones 5 (83.3%) p 0.018. Ultimately 13 (4%) of them necessitated urological interventions within 90 days of their ED visit (p 0.001).

Other diseases unrelated to urolithiasis were seen in 13 (4.3%) patients (Table 3), none of whom required subsequent CT imaging.

Discussion:

Interpretation of results: This study, demonstrated that the emergency department ultrasound is able to predict low risk renal stone disease patients who could safely be discharged from the ED. To our knowledge, this is the first study in the region which attempted to protocolize the care of this type of patients in the ED.

Previous Studies: A previous study done by Johnaton R et al in the British Journal of Urology 2009 attempted to look for alternative modality with minimal radiation exposure. They assessed the sensitivity of CT and x-ray KUB in detecting urinary tract stones. They concluded that the decision to use KUB for follow up can be made after using the CT for diagnosis as it's enough in about 63% of the cases with the benefit of minimizing radiation exposure. Other modality used is intravenous pyelogram (IVP). M Quirke et al studied in 2002 retrospectively the ED Length of Stay (LOS) in patients presenting with renal colic comparing the usage of NCCT vs IVP. They concluded that there was a two fold increase in LOS by using NCCT in comparison to IVP with the higher incident of detecting other alternative diagnosis that may not be otherwise detected in patients with renal colic.

Patatas warned of the routine use of CT scan in the investigation of renal colic patients. Patatas K et al in the British Journal of Radiology retrospectively studied in 2012 the rate of urolithiasis and outcome of CT KUB in ED for patients presenting with acute renal colic and concluded that routine use of CT in patient with flank pain should be avoided specially in female patients, and only 0.2% of those patients needed ureteroscopy for stone removal which is compatible with our study.

Bedside renal US in the evaluation of urolithiasis was studied in 2010 prospectively by James H et al and he argued that bedside US had only a limited impact on the physicians clinical impression of patients with possible ureterolithiasis with modest sensitivity to detect any ureteral stones but much higher for detecting larger stones.

One of the studies which looked into using renal US in low risk patients was by Justin W et al in CJEM in 2014 .In this study they attempted to determine if normal US done by trained ultrasonographers could identify low risk renal colic patients (not requiring urological interventions within 90 days) within 90 days of their initial ED visit .They found that the rate of urological intervention was significantly lower in those with normal US results (P <0.001) than in those with abnormal findings. Our study has supported Marcia L Edmonds et al study which was done in 2009 & concluded that normal US result in low risk renal colic pts can predict low likelihood for urological intervention within 90 days of ED presentation.

In underdeveloped countries where distribution and utilization of resources are of integral importance to the health system. Wide availability of CT scan in such system is very limited .Ultrasound provides a safe alternative option to such patients .Furthermore; it ultimately avoids the risk of unnecessary exposure to radiation. Our routine practice in this part of the world is to use Ultrasound as the first investigation modality, for Patients presenting to the ED with 1st time renal colic. Ultrasound is used as a triaging tool that helps planning further care. There are special situations where clinicians are obliged to use ultrasound as 1st modality e.g. in pregnancy and young women.

Limitations:

Being of a retrospective design is one of the limitations of this study .This has resulted in missing Other important information) e.g. duration of pain, lost time from work or other activities, subsequent visits to other hospitals, need for ongoing analgesia, or other treatment other than urological, missed information in the chart) all of which may have contributed to the final results.

Conclusion:

Though it is still challenging for ED physicians to implement this practice, we recommend, to adopt ultrasound as first line diagnostic modality in the investigations of renal colic patients. Further prospective studies could be done to further prove those findings.

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Table 1: Baseline characteristics of 302 patients who underwent ED ordered renal US

Characteristic	N=302
Mean age ,years	34
Male sex	202 (67%)
Arrival by Ambulance	2 (0.7%)
Admission	15 (5%)
Emergency Department length of stay	2 hours
Past Medical History:	
HTN	16 (5%)
DM	13 (4%)
Cardiovascular Diseases	10 (3%)
Urological Diseases	28 (9%)

Table 2 : Outcomes of 302 Emergency Department renal US procedures ordered for suspected urolithiasis

Characteristic	N=302
Normal ultrasound	92 (30%)
Abnormal ultrasound	210 (70%)
: Suggestive of urolithiasis visualized	113 (37%)
ureteric stones	76 (25%)
Combination Diseases unrelated to urolithiasis	8 (3%)
	13 (4%)
	4 (1.3%)
	40 (13%)
	34(11%)
	6(2%)
Urological interventions within 90 days of Emergency Department visit:	51 (16%)
Normal US group	5 (1.7%)
Abnormal US groups:	
-Suggestive of urolithiasis	31 (10%)
-Visualized ureteric stones	13 (4%)
- Combination	1 (0.3%)
-Diseases unrelated to urolithiasis	1 (0.3%)

Table 3: Final diagnosis of 13 pts with abnormal findings on US unrelated to urolethiasis

Diagnosis	Number, Percentage
Renal parenchymal disease	1 (0.3%)
pyelonephritis	1 (0.3%)
Cortical renal cyst	1 (0.3%)
Diabetic nephropathy	2 (0.7%)
Ovarian cyst	1 (0.3%)
Uterine fibroid	1 (0.3%)
Adrenal cyst	1 (0.3%)
Fatty Liver	3 (1%)
Vascular lesion	1 (0.3%)
Gall stones	1 (0.3%)