Research Article

Predictability of Computerized Tomography as Compared to Ureteroscopy in Detection of Ureteric Stone in Patients with Indwelling Stents

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Abstract

Objective: The current gold standard for the diagnosis of ureteric stones in patients with a stent in situ is ureteroscopy but this study is planned to determine the positive predictive value of computerized tomography (CT) scan among such patients.

Methods: This study involved patients who had ureteral stent in situ and were referred for re-evaluation of residual stones after extracorporeal shock wave lithotripsy. These patients underwent CT-scan for detection of ureteric stone. Later on, ureteroscopy was performed and ureteric stone was confirmed on direct visualization.

Results: The mean age of the patients was 32.2±8.9 years. Male to female ratio of 1.7:1. CT scan shows a stone in 252 patients (70.2%) out of which 165 (46.0%) were confirmed on ureteroscopy. This yielded a sensitivity of 88.7 %, specificity of 49.7 %, positive predictive value of 65.5%, negative predictive value of 80.4% and diagnostic accuracy of 69.9% of CT for detecting ureteric calculi in patients with ureteric stents (p value < 0.0001).

Conclusion: CT scan owing to its limited diagnostic accuracy cannot replace ureteroscopy for detection of ureteric stones in patients with ureteric stents.

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Introduction:

The overall prevalence of urinary tract stones has been estimated to range from 2% - 20% which has been increasing over the last 2 decades. Around 20% of these occur in the ureter[1].

Ureteric calculi are associated with significant morbidity ranging from hydronephrosis and hydroureter to infection and even renal failure[2]. Timely intervention can save the patient from these morbidities. Different treatment options are available for this purpose including ureteroscopic lithotripsy (URL), extracorporeal shock wave lithotripsy (ESWL), medical therapy, percutaneous nephrolithotomy and laparoscopic surgery[3,4]. Out of these, URL and ESWL are the most widely used and successful options[5].

Ureteral stents are one of the most common and versatile tools used by urologists[6]. Ureteral stents are routinely placed in patients encountering extracorporeal shock wave lithotripsy in order to reduce the morbidity caused by ureteral trauma by this procedure[7,8] although the evidence for this remains controversial[9,10].

Tang et al. in 2011 assessed the use of CT scanning versus ureteroscopy in detecting ureteric calculi in patients with stents and found that the positive predictive value (PPV) of computed tomography (CT) in diagnosing ureteral stone in such patients was 63%[10].

While CT scan is more sensitive, specific and accurate than ureteroscopy in detection of ureteric stones pre operatively[11], its value post intervention is unclear. This is due to difficulty in perceiving stone from the stent on CT when using soft tissue window settings. Using bone window settings may improve accuracy[12], but this met-

hod has not been validated. Nevertheless, studies show that it is over optimistic to declare a patient stone free just on the basis of ureteroscopy without any imaging[13]. Therefore, it is important to assess whether CT scan can be comparable to ureteroscopy in detecting ureteric calculi in subset of patients having stents in place.

The aim of this study was to decide the positive predictive value of computed tomography in diagnosing ureteral stones with ureteral stent in situ taking ureteroscopy as gold standard.

Methods:

This was a cross sectional study carried out at a tertiary care center. The center was funded by the government so majority of the cases belonged to the poor socioeconomic status. After approval from ethical review committee of the hospital, patients with ureteric stents who had suspicion of ureteric stone based on clinical history or ultrasound, were enrolled by the Radiology Department, Mayo Hospital Lahore. Written informed consent and detailed history was taken from each patient at the time of enrollment. Patients were selected consecutively by using non purposive consecutive sampling method. Sample size of this study was calculated as 359 by WHO calculator taking an expected percentage of positivity as 63%[10].

It was made sure that only those patients were included in the study who had strong suspicion of the ureteric stone on clinical examination irrespective of the gender and age. Patients who were pregnant at the time of study and visible hip graft (due to difficulty in imaging interpretation from artefacts), were excluded from the study. Patients not willing to undergo ureteroscopy were also excluded.

Patients underwent helical CT using a 1mm slice collimation without intravenous or oral contrast. The CT scans were then assessed on standard abdomen and bone window settings to look for ureteric stones (Figures I and II).

The patients then underwent ureteroscopy to look for ureteric calculi and their presence or absence was noted. All the data was recorded into the attached proforma along with demographic details of the patient. All the ureteroscopic examinations were performed by the same consultant of the Urology department having 5

Figure 1: *Axial images at soft tissue (A) and bone (B) window settings depicting stent (green arrow) and calculus (white arrow) with the difference between them more conpicuous at bone window settings*

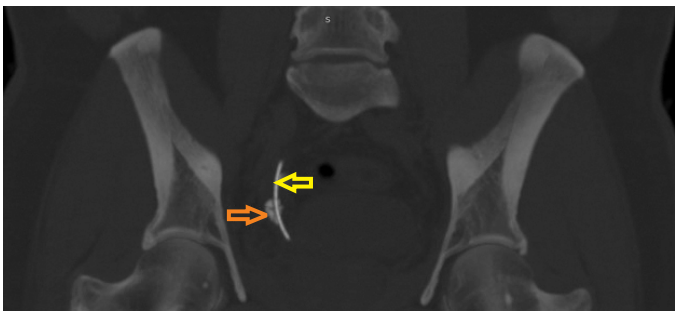

Figure 2: *Coronal section at bone window settings with MIP projection clearly depicting stent (green arrow) and calculus (orange arrow)*

years post fellowship experience and all the computerized tomography scans were performed on the same machine and were reported by the same radiologist

having 5 years post fellowship experience to eliminate bias. Confounding variables were controlled by exclusion criteria.

The data were then entered into SPSS. Mean and standard deviation of quantitative variables was calculated. 2x2 table was constructed to tabulate true and false positives and negatives. The sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy was then calculated.

Results:

The mean age of the patients was 32.2±8.9 years (20 years to 50 years). There were 224 (62.4%) males and 135 (37.6%) females in the study population.

CT scan showed a stone in 252 patients (70.2 %) out of which 165 (46.0%) were true positive. There were 82 (22.8%) true negative patients. This yielded a sensitivity of 88.7 % and specificity of 49.7 % of CT in detecting the presence of ureteric calculi in patients with stents in place. The positive and negative predictive values were 65.5% and 80.4% respectively. Overall diagnostic accuracy was 69.9% with p value < 0.0001. (Table 1)

Table 1 *shows the tabulated results of the study*

		Ureteric stone on ureteroscopy		Total	P value
		Present	Absent		
Ureteric stone on CT	Present	165	87	252	< 0.0001
	Absent	21	86	107	
Total		186	173	359	

Discussion:

Diagnosis of ureteric stones prior to any intervention is relatively straightforward but it is not so in post operative patients such as ones having indwelling catheters. Ureteroscopy is considered gold standard, however has a number of disadvantages such as invasiveness, need for procedure room arrangement, anesthesia and cost[4]. CT overcomes these advantages although it is less specific having a PPV of 65.5% as compared to ureteroscopy.

There is dearth of local as well as international data on comparison between CT scan and ureteroscopy for stone detection in patients having catheters.

Studies done regarding the efficacy of different treatment options for ureteric stents in local population have reported a similar mean age group as our study. Rahim et al. (2012) and Bajwa et al. (2013) reported a comparable mean age group of study population of 32.40± 10.28 years and 33.15±18.97 years separately in patients having ureteric stones at Shaikh Zayed Hospital, Lahore[14,15]. A slightly higher mean age was found in studies by Pirzada et al. in 2011 (36.3±14.8 years) and Khan et al. in 2011 (37.37±7.51 years) among patients with distal ureteric stones at Liaquat National Hospital Karachi and Khyber Teaching Hospital, Peshawar individually[16,17]. On the other hand, mean age of 48.2±0.6 years has been reported in Italian population by Porpiglia et al. in 2006[18]. The difference from our study group could be accounted for by the different ethnicity and racial differences.

A comparable male prevalence has likewise been accounted for by Khan et al. in 2011 (1.5:1), Bajwa et al. in 2013 (1.8:1), Rahim et al. in 2012 (2.3:1) and Pirzada et al. in 2011 (3:1) among patients with ureteric calculi in Pakistani population (15-18). Park et al. (1.5:1), Kuyumcuoglu et al. (1.3:1) and Lim et al. (1.3:1) revealed comparable male: female ratio among such patients in China[19,21]. However, much higher male preponderance was seen by Sitharamaiah et al. in 2015 (5.7:1) and Singh et al. in 2011 (3:1) among Indian patients[22,23].

In the present study, the positive predictive value of CT in predicting ureteric calculi was found to be 65.5%. Negative predictive value was 80.4 % and diagnostic accuracy (69.9%). This is comparable to study done in Australia which reported positive predictive value, negative predictive value and diagnostic accuracy of CT for ureteric calculi in patients with stents as 63%, 76 % and 67% respectively[10].

The present investigation is first of its sort in neighborhood populace and adds to the constrained worldwide research proof on the theme. In the present investigation, we found that in patients with ureteral stent in situ, processed CT images had positive predictive value of 65.5% in the ureteric stones taking ureteroscopy as gold standard, which alongside its non-invasive nature and wide spread accessibility advocates its favored use in future practice. A significant limitation to the present study was that we did not stratify the predictive value of

CT over different stone sizes which is a significant impact modifier and ought to be tended to.

Conclusion:

Detection of ureteric calculi in patients with indwelling catheters presents a diagnostic challenge, yet is important for patient management. The current gold standard - ureteroscopy is an invasive and expensive procedure with limited availability. CT overcomes these disadvantages however has a limited PPV and NPV and cannot currently replace ureteroscopy for this purpose.

Ethical Approval: Given

Conflict of Interest: The authors declare no conflict of interest.

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