



COMPARISON OF X-RAY KUB AND UNENHANCED HELICAL CT FOR THE DETECTION OF RESIDUAL CALCULI IN POSTOPERATIVE URSL PATIENTS: IMPLICATIONS OF POSTOPERATIVE FOLLOW-UP

Urology

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ABSTRACT

Introduction and Objective: To assess the sensitivity and specificity of KUB radiography and Unenhanced Helical CT for identifying ureteric calculi in post-operative URSL patients. **Methods:** We assessed the films of X-ray KUB and Helical CT taken on the 2nd postoperative week of 130 patients. Location, size, number of calculi and HU were recorded and compared. **Results:** 82 patients were males and 48 patients were females in our study. For 118 patients, stones were visible in the preop X-ray KUB and for 12 patients stones were not visible in preop X-ray. All stones visualized in preop X-ray KUB were also detected in CT. Mid ureteral stones are the ones which was not visible in the X-ray KUB, but was visualized in CT when compared to the proximal and distal ureteric stones. The sensitivity and specificity of Postop X-ray KUB in detecting Residual Ureteric calculus is 24% and 100%. The Sensitivity and Specificity of Postop CT in detecting Residual Ureteric calculus is 100% and 82%. **Conclusions:** The sensitivity and specificity of Post URSL CT scan is better than that of Postop X-ray KUBs. A high index of suspicion is required in the post op setting to label the patient as Stone free and Non contrast CT should not be with-held if deemed necessary.

KEYWORDS

XrayKUB, CT, Helical CT, Postoperative URSL, URSL.

INTRODUCTION:

Ureteroscopic management of ureteric stones has evolved a lot during the last 3 decades. Various technological advancements, including deflectable tip endoscopes, ureteral access sheaths, superior optics, and improved lasers and stone retrieval devices have expanded indications for ureteroscopic management to include renal and upper ureteral stones. The ideal goal of ureteroscopic lithotripsy is to give a complete clearance of the ureteric stones¹.

The literature on SWL introduced the concept of clinically insignificant RFs to refer to stones 4 mm or less that would presumably pass spontaneously. However in clinical practice, there is an increasing number of patients who are deemed stone free by post op Xray KUB presents with RFs causing significant pain and symptoms requiring hospitalization. Longitudinal series also found that these RFs do not necessarily always pass and can often grow with resultant clinical sequel².

Moreover, since significant number of patients have a DJ stent following URSL, it will be difficult to determine the ureteric stone free status based on Xray KUB. So, in order to determine the best imaging modality to determine the ureteric stone free rate, the commonly used X-ray KUB is compared with Non enhanced CT-KUB.

MATERIALS AND METHODS:

From 2022 January to 2023 January, 130 patients who were diagnosed to have ureteric calculus were selected for the study. This study included patients with symptomatic ureteric stone size of 15 mm or less, whose age ranges from 18 years to 69 years, diagnosed with ureteric calculus identified through non-contrast helical CT scan and kidneys, ureter, urinary bladder (KUB) radiograph taken within 2 days, who underwent URSL by either pneumatic lithoclast or Holmium laser along with DJ stenting. Excluded cases were those with suboptimal KUB radiograph classified as having intervening bowel gas or very dense fat, URSL cases without DJ stenting, Failed URSL cases and patients who were not willing for post op CT.

All the URSLs were done by semirigid ureteroscopes. Both laser and pneumatic lithotripsy was used. The selected patients were reviewed 2 weeks after the URSL.

History and Physical Examination was done. The patients were advised to undergo non-contrast helical CT and KUB radiographs on the same day. The 1) number of calculi, 2) diameter of the largest target calculus (0 to 5, 6 to 10 or greater than 10 mm), 3) location (proximal, mid or distal), 4) Hounsfield units from the preop and post op CTs were compared. The 1) visibility of the calculi, 2) number of calculi, 3) diameter of the largest target calculus (0 to 5, 6 to 10 or greater than 10 mm), 4) location (proximal, mid or distal) from the preop and postop Xray KUBs were compared.

Residual Fragments were defined as any residual ipsilateral renal or ureteral calculus greater than 6 mm. When RF size was not provided by the radiology report, institutional imaging software was used to measure calculus size. When multiple residual calculi were present, the diameter of the largest RF is reported.

Statistical Analysis:

The association of non-contrast CT characteristics of ureteral calculi and their visibility on KUB was analyzed using chi-square test or Fisher's exact test (categorical variables) and two-sample independent t-test (continuous variables). Multivariate analyses using logistic regressions were computed to address predictors for visibility on KUB. All p-values were two sided and considered significant if <0.05 . Visibility of ureteral calculi on KUB was further stratified by significant predictors.

RESULTS:

82 patients were males and 48 patients were females in our study.

Preop Ct:

107 patients had a single ureteric calculus and 23 patients had 2 ureteric calculus in preop CT. 74 patients had stone size of 6-10 mm and 56 patients had stone size >10 mm in preop CT. 55 patients had proximal ureteric calculus, 23 patients had mid ureteric calculus and 52 patients had distal ureteric calculus. 11.5% of cases had HU between 400-600, 39.2% of cases had HU between 601-800, 13.1% of cases had HU between 1000-1200, 26% of cases had HU between 1201-1400, 10% of cases had HU >1400 .

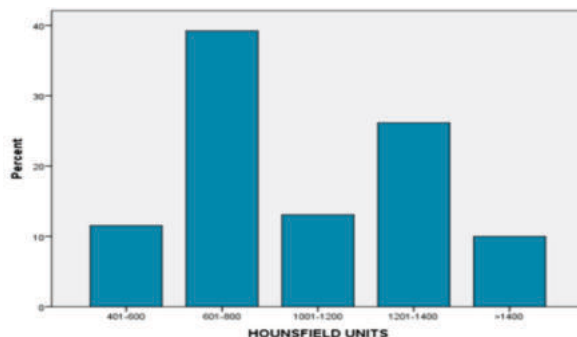


Figure 1: Bar chart demonstrating the distribution of cases in percentage in relation to the HU in preop CT.

Preop Ct And X-ray Kub Comparisons:

For 118 patients, stones were visible in the preop X-ray KUB and for 12 patients stones were not visible in preop X-ray. All stones

visualized in preop X-ray KUB was also detected in CT. 9% of stones were not detected in preop X-ray KUB, these stones were detected in CT. 84% of 6-10mm calculi in CT were detected in preop X-ray KUB. All calculi >10 mm were detected in preop X-ray KUB.

Table 1 : Comparison of Preop CT and Xray in detection of calculi.

PreCTHU * PreXVisibility Crosstabulation				
			Preop Xray	
			Stone Visible	Stone Notvisible
PreCTHU	Count			
401-600				
	Count		10	5
	% within PreCTHU		66.7%	33.3%
601-800				
	Count		44	7
	% within PreCTHU		86.3%	13.7%
1001-1200				
	Count		17	0
	% within PreCTHU		100.0%	0.0%
1201-1400				
	Count		34	0
	% within PreCTHU		100.0%	0.0%
>1400				
	Count		13	0
	% within PreCTHU		100.0%	0.0%
Total				
	Count		118	12
	% within PreCTHU		90.8%	9.2%

For 98 cases pneumatic lithotripsy was used and for 32 cases laser lithotripsy was used.

Postop CT and X-ray KUB comparisons:

Post X-ray KUB:

In 5.4% of cases stones were detected (7 in 130 patients). All the calculi which was visible was proximal ureteric calculi. 5 calculi which was detected in X-ray KUB were approx. 0-5mm in size. 2 calculi which was detected in X-ray KUB were approx. 6-10 mm in size. All stone which was detected in postop X-ray were also detected in Postop CT KUB. In 123 patients (95%) in whom the post op X-ray KUB shows no stone, 22 patients (18%) had evidence of stones (Residual fragments) in CT. Of these 22 patients 10 patients were symptomatic, of which 6 patients were posted for Re-URSL.

Table 2 : Comparison of postop X-ray vs. CT in detection of calculi.

PostXVisibility * PostCTNoCalculi Crosstabulation				
			PostCTNoCalculi	
			Presence of calculi	No calculi
PostXVisibility	Count			
Visible				
	Count		7	0
	% within PostXVisibility		100.0%	0.0%
Notvisible				
	Count		22	101
	% within PostXVisibility		17.9%	82.1%
Total				
	Count		29	101
	% within PostXVisibility		22.3%	77.7%

Of the visible calculi in X-ray, all were seen in CT. Of the non-visible calculi in X-ray, 22(18%) calculi were detected in CT. Of the stones which was detected in only CT, most of the stones are 2-5mm in size (15%) and 2.4% of only CT visible stones are 6-10mm in size. Of the 18% CT only visible stones, 8% of the stones were seen in midureter, 6.5% stones seen in distal ureter and 3.3% stones in proximal ureter. Of the 18% CT only visible stones, 15% of the stones are in the HU range of 400 to 600, 7% are in the 200 to 400 HU range.

Mid ureteral stones are the ones which were not visible in the X-ray KUB, but was visualized in CT when compared to the proximal and distal ureteric stones.

Laser Energy has the highest stone clearance rate when compared to pneumatic lithotripsy.

Sensitivities and Specificities:

The sensitivity and specificity of Postop X-ray KUB in detecting Residual Ureteric calculus is 24% and 100%. The NPV of Postop X-ray KUB is 100% and NPV is 82%. The Sensitivity and Specificity of Postop CT in detecting Residual Ureteric calculus is 100% and 82%. The PPV of Postop CT is 24% and NPV is 100%

DISCUSSION:

Unenhanced helical CT has become widely accepted as the imaging study of choice for diagnosing ureteral calculi. The complete clearance of ureteric calculus needs to be ensured to prevent silent obstruction of the kidney that lead to irreversible damage if it lasts for more than 2 weeks, especially if it is infected¹.

able to consistently and reliably identify the calculus⁴. Although UHCT can detect nearly all ureteral calculi, its role in follow up is limited because the radiation exposure is more than 10 times greater than KUB⁵.

Our study showed that all the calculi visualized post op was also seen in CT and of the non-visible calculi in X-ray, 22(18%) calculi were detected in CT. The sensitivity and specificity of Postop X-ray KUB in detecting Residual Ureteric calculus is 24% and 100%. The Sensitivity and Specificity of Postop CT in detecting Residual Ureteric calculus is 100% and 82%. This study indicates that calculus density and non-middle ureteral location are significant predictors of their visibility on X-ray KUB⁶.

Furthermore, when a ureteral calculus is located in the middle ureter, it is usually not visible on KUB⁷. The sacral density and bowel contents can obscure the radiopacity of a middle ureteral calculus, which makes it undetectable on KUB⁸.

CT is useful for detecting nonvisible X-ray KUB stones especially the mid ureteral stones. Preop CT stone densities were predictive of visibility of the stones in both Postop X-ray and Postop CT. CT may be omitted in the follow up settings if the Preop CT densities are <400HU.

CONCLUSIONS:

The sensitivity and specificity of Post URSL CT scan is better than that of Postop X-ray KUBs. A high index of suspicion is required in the post op setting to label the patient as Stone free and Non contrast CT should not be with-held if deemed necessary.

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Therefore, it is imperative that the chosen follow-up imaging study be