



Prospective Comparative Study of Noncontrast Ct KUB and CT IVU

KEYWORDS

NCCT KUB, URETERIC STONE, CT IVU, RENAL CALCULUS

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ABSTRACT *OBJECTIVE: To correlate diagnostic ability of Noncontrast CT Scan and CT Intravenous Urography findings in same patients .*

MATERIAL AND MEHTODS : Patients suspected for Urolithiasis or Obstructive uropathy sent for CT IVU were selected as cases. All Patients underwent NCCT KUB first followed by IVU. Findings of NCCT KUB were recorded first , followed by findings on CT IVU. Radiologist was kept unaware of clinical history. Findings like hydronephrosis, hydroureter, fullness of PC System, Ureteric Stricture, calculus, perinephric fat stranding, peripelvic and periureteric fat stranding , ureteric wall thickening and renal cysts were compared in both. From these records findings on NCCT KUB and IVU were correlated.

RESULTS : The present study includes 100 cases. 95 patients have positive findings on NCCT and 92 on IVU. On NCCT 222 stones were detected from which 155 renal calculi, 59 ureteric and 8 bladder calculi . The findings detected on NCCT were hydronephrosis in 56 hydroureter in 52, perinephric stranding in 12, periureteric fat stranding in 25, ureteric wall thickening in 18, renal mass in 1 and renal cyst in 18 each.

The findings detected on CT IVU were similar in addition nonexcretoy kidney detected in 10 patients, delayed excretion in 26 patients, ureteric stricture detected in 8 patients. .In addition possibility of renal mass and angiomyolipoma suggested on NCCT KUB were better evaluated after CT IVU.

CONCLUSION : NCCT KUB is superior in detecting calculus, especially for stones in the mid or lower ureter. Characteristic of obstruction- partial or total was only detected by IVU. An added benefit of NCCT is lowering radiation, cost effectiveness, deciding HU of calculus as well usefulness in patients with high creatinine.

INTRODUCTION

Urolithiasis is one of the commonest pathology being diagnosed by a radiologist in day to day life. Also its highly prevalent in general population. Even being a benign pathology it can give extreme colicky pain as well can compromise renal function if causing backpressure changes and are not diagnosed timely.

Being a very common pathology there is very important need of evaluation of radiation hazards versus diagnosis benefits of CT Scan as a modality to diagnose and provide details of calculi and obstruction. Multidetector CT has made it possible to acquire thin slices for large body area in a single breath hold.¹

Also there are possible side effects of contrast media needed for IVU. So the usefulness of CT IVU must be decided and defined.

Single NCCT KUB scan is having lesser radiation then the possibly multiple CT IVU scan which also carries risk of possible contrast media hazard.

Thus prons and cons of NCCT KUB over CT IVU must be decided.

NCCT KUB is the imaging modality of choice for diagnosis of urolithiasis. However it gives no information of function of kidneys as well cannot clearly reveals obstructive nature of calculus.

Sensitivity and specificity of NCCT KUB for detection of ureteral calculi Is 98% and 97% respectively.²

MATERIAL AND METHODS

During the period of January 2015 to October 2015, a prospective study of 100 patients was carried out. The study group consisted mainly of patients from different parts of Gujarat and also some from other states like Rajasthan and Madhya Pradesh.

Relevant history of illness and significant clinical findings of all patients were recorded. Previous investigations were reviewed.

Patients who were clinically suspected for urolithiasis or other genitourinary pathologies, who undergone USG examination, and found to be having urolithiasis or obstructive uropathy or both were later on underwent CT scan examination.

All the CT scans were done on SIEMENS somatom definition 128 slice multidetecor CT Scan Machine.

Following CT Technique was used in all patients :-

Plain CT scan of abdomen (without IV or Oral contrast) was taken from diaphragm upto pubic symphysis. & detail report was written. ne. 16X0.625 mm Collimation, 5 mm Slice thickness, 1.75 Pitch with Table speed/gantry rotation -55mm/17.5 mm were used.

Then patients were given intravenous bolus of non-ionic iodinated contrast material via power injector. 100 cc of contrast was administered at rate of 3.5 ml/sec. CT IVU scan, was done under the supervision of the anesthetist.

Contrast-enhanced CT scans then are obtained from the dome of the liver to the pubic symphysis at 5-mm section thickness 90 seconds after starting intravenous administration. These typically demonstrate homogeneous nephrogram (the uniform or homogeneous nephrographic phase), followed by 15 minutes later scan. Abdominal compression is not applied in any of the enhanced CT scans. After 15 minutes evaluation of excretion of contrast was checked and decision about requirement of further scans was taken.

NCCT KUB and CT IVU findings were noted and correlated. The results of this study were analyzed and compared with other available studies in literature.

RESULTS

Table-1 FREQUENCY OF VARIOUS PATHOLOGIES

In this study most common pathology was multiple bilateral renal calculi (17%), followed by hydronephrosis (15%).

Diagnosis	No. of Patients	Percentage
Single Renal Calculus	25	25%
Multiple Unilateral renal calculi	55	55%
Multiple bilateral renal calculi	40	40%
Renal Pelvic calculus	21	21%
Staghorn calculus	14	14%
Hydronephrosis	56	56%
Hydroureter	52	52%
Upper ureteric calculus	12	12%
Midureteric calculus	8	8%
Lower ureteric calculus	39	39%
Urinary bladder calculus	8	8%
VUJunction calculus	33	33%
PUJunction calculus	6	6%
PUJ Obstruction	4	4%
Extrarenal Pelvis	10	10%
Renal Cysts	12	12%
Ureteric wall thickening	28	28%
Pelvic wall thickening	22	22%
Ureteric wall thickening	28	28%
Ureteric Stricture	8	8%
Delayed excretion of contrast	26	26%
Nonfunctioning kidney	10	10%
Angiomayolipoma	1	1%
Renal cell carcinoma	1	1%

Table - 2 Renal Calculi on NCCT KUB vs CT IVU

Renal Calculi were detected both on NCCT KUB and CT IVU. However in CT IVU image contrast has to be adjusted to proper visualization of the calculus.

Location of Calculus	No. of Patients	Percentage
Calyceal	80	80%
Renal Pelvic	21	21%

Table - 3 Ureteric Calculi and Urinary Bladder on NCCT KUB vs CT IVU

Ureteric and Urinary calculi were easily identified on NCCT KUB. However on CT IVU calculi are visible on adjusting the contrast only.

Ureteric calculi	No. of Patients	Percentage
Upper ureteric	12	12%
Midureteric	8	8%
Lower ureteric / VUJ calculus	39	39%
Urinary Bladder Calculus	6	6%

Table - 3 Hydronephrosis And Hydroureter on NCCT KUB vs CT IVU

Hydronephrosis and hydroureter is diagnosed with precision on both NCCT KUB and CT IVU. However on CT IVU hydronephrosis and hydroureter were more quickly depicted.

Hydronephrosis	No. of Patients	Percentage
Mild hydronephrosis	24	24 %
Moderate hydronephrosis	7	7%
Gross hydronephrosis	26	26%
Mild hydroureter	26	26%
Moderate hydroureter	22	22%
Gross hydroureter	12	12%

DISCUSSION

With the introduction of multi-detector computed tomography (MDCT), the urologic evaluation of patients has changed. Intravenous Urography (IVU) has been the initial modality for patients with hematuria, flank pain, and other urologic diseases for the past 5 decades.³ But now it has been partially or completely replaced by use of MDCT.

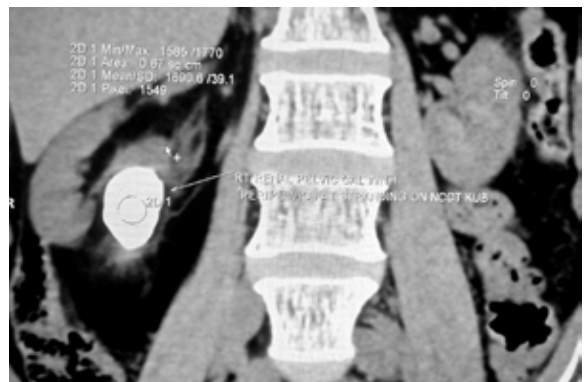
CT is the best investigation to detect calculi causing acute loin pain. Even calculi that are radiolucent and not Detected on routine X ray KUB are readily detected and signs of obstruction like hydronephrosis, hydroureter, enlargement of kidney, perinephric or periureteric fat stranding etc depicted.¹

Also NCCT KUB is fast and better in suspected urolithiasis patient then going for time consuming both X ray KUB and USG. As well the overall accuracy of NCCT was superior to that of combined X ray KUB and USG.⁵

Renal calculi

In present study, there were 40 cases of renal calculi, from which 26 cases are of renal calculi as single pathology.

NCCT KUB is mandatory to decide HU urolithiasis. While in CT IVU due to contrast opacification it is difficult to decide to decide the hydroureter.



NCCT KUB showing right renal pelvic calculus with fat stranding and HU



CT IVU - Right Renal Pelvic calculus with fat stranding and contrast excretion

Uterteric Calculi

In present study, there were 40 cases of Ureteric calculi were diagnosed on both CT IVU and NCCT KUB . Thus both NCCT KUB and CT IVU were equally sensitive and specific for detection of ureteric calculi. ³ However in CT IVU we have to adjust the image contrast to visualize the calculus ,while in NCCT KUB there was no need of such adjustment.

NCCT KUB is the best imaging modality as it has high sensitivity (98%) and specificity (97%).²

Hydronephrosis and hydroureter :

Hydronephrosis and Hydroureter were detected with precision on both NCCT KUB and CT IVU. However on CT IVU it is better evaluated due to presence of contrast as well associated ureteric wall thickening is better appreciated.

Excretory function of kidney

There is no e/o any indirect Signs of competency of excretory function noted in NCCT KUB..CT IVU is mandatory for evaluation of excretory function of kidney.

10% of patients found to have nonexcretory kidney in our study on CT IVU.



NCCT KUB showing Right PUJ Obstruction



CT IVU - Contrast Excretion in Right PUJ Obstruction in 5 hrs delay scan

Other Pathologies

In present study, there were 1 cases of Angiomayolipoma was diagnosed both on CT IVU and NCCT KUB, 1 case or Renal cell carcinoma which was suggested as a possibility on NCCT KUB and confirmed on CT IVU.

Both CT IVU and NCCT KUB were accurate in diagnosing ureteric or pelvic wall thickening or peripelvic or periureteric fat stranding.

Radiation Exposure

In a study by McTavish et al estimated skin doses from CT urography performed with the tripple-phase CT scan were similar to those of standard IVU, while the total effective doses from CT urography were approximately two times higher than those of conventional IVU.⁷ Thus as minimum more of 2 phases used in CT IVU it has significant higher radiation exposure then NCCT KUB .

Turn Around time in the study

Average turn around time in NCCT KUB is less than 5 minutes,³ while in CT IVU it is 20 minutes if delayed scan not need to be obtained. Thus NCCT KUB is far more faster then CT IVU. ⁴

Adverse Events

There were no adverse events noted in NCCT KUB .However in CT IVU among 100 patients 12 patients had side effects in form of vomiting and itching. No serious reaction to contrast media noted in this study.

SUMMARY AND CONCLUSIONS

- NCCT KUB by virtue of less radiation, no side effects of contrast media, less time consuming and is cheaper as compared to CT IVU.
- NCCT KUB has similar ability to demonstrate structural changes in Genitourinary system.
- NCCT KUB is also necessary to decide Housenfield units(HU)of calculus.
- NCCT KUB is also possible in patients with high creatinine in which CT IVU is contraindicated.
- CT IVU having more radiation exposure as well is being more time consuming is difficult in uncooperative patients and children.
- CT IVU exposes patient to possible side effects of contrast injections.
- CT IVU is particularly useful to know the excretory function of kidney which is totally lacking in NCCT KUB.

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