

## Comparison of Computed Tomography Urography and Sonographically Tailored Intravenous Urography in Patients of Urolithiasis

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**Abstract:** Urolithiasis is a common problem in the population occurring across all age groups. Among multiple diagnostic procedures available for diagnosing this condition, CT urography has been considered as the gold standard procedure. However, its availability, cost and radiation dose are major prohibiting factors. This study compares sonographically tailored IVU to CT urography to assess the efficacy of the aforementioned procedure in patients of urolithiasis. 61 patients with radiological diagnosis of urolithiasis underwent Sonographically tailored IVU and CT urography in the Department of Radio-Diagnosis, Burdwan Medical College and Hospital. The sensitivity, Specificity, positive predictive value, negative predictive value and accuracy of Sonographically tailored IVU in detection of urolithiasis were 90.19%, 80%, 95.83%, 61.53%, 88.5% respectively.

Hydronephrosis was detected in 20 out of 61 cases in CT urography, and in 17 in sonographically tailored IVU. The sensitivity, specificity, positive predictive value, negative predictive value and accuracy of sonographically tailored IVU in detection of hydronephrosis were 75%, 95.12%, 88.23%, 88.63%, 88.52% respectively. To conclude, sonographically tailored IVU, has high sensitivity and positive predictive value in evaluation of urolithiasis which makes it a competent replacement of CT urography in a limited resource scenario.

**Keywords:** CT urography, IVU, urolithiasis, sonography

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### I. Introduction

Urolithiasis is a fairly common problem in the population occurring across all age groups. It is notorious for its presentation as an acute abdominal pain. Multiple etiological factors have been associated with it including dehydration, urinary stasis and others. Among multiple diagnostic procedures available for diagnosing this condition, CT urography has been considered as the gold standard procedure, superior to ultrasonography or conventional intravenous urography. However, its availability, cost and radiation dose are some of the reasons why it is still not preferred or performed as prevalently as expected. This study compares sonographically tailored IVU to CT urography to assess the efficacy of the aforementioned procedure in patients of urolithiasis, since it uses less radiation and combines sonography and IVU to produce better yield. It also aims to weigh the advantages and disadvantages of both procedures.

### II. Aims And Objectives

1. Establishing diagnostic accuracy of sonographically tailored IVU.
2. Comparing CT urography with sonographically tailored IVU in patients of urolithiasis in terms of diagnostic accuracy.
3. Comparing the advantages and disadvantages of both protocols to determine the imaging of choice.

### III. Materials And Methods

This study was conducted in the department of Department of Radio-Diagnosis, Burdwan Medical College and Hospital, Burdwan, from July 2017 to June 2018. This study included 61 patients who presented in our Department for the purpose of excretory urography with radiological diagnosis of urolithiasis, abiding by the inclusion and exclusion criteria. All these patients underwent sonographically tailored Intravenous Urography and Computed Tomography Urography after providing consent and detailed history in our department and the result were recorded in a predesigned proforma. Meticulous clinical examination was also

done in all the. All the patients were followed up with serial imaging by ultrasound and any history of extrusion or extraction of calculi were duly noted.

For sonographically tailored IVU, the patient first underwent ultrasonography with curvilinear transducer of 2-5 MHz for detection of calculi and determination of its size, location, number and laterality. Presence of hydronephrosis and other findings were also noted. After that the patient underwent tailored IVU with 50 ml of iodinated contrast media (Iohexol 300).

For children the amount of volume of contrast injected was 2ml/kg. Adequate hydration was maintained in the patients to reduce the chances of nephrotoxicity. As a pre-requisite, proper bowel preparation was done.

Three views were taken for the IVU

1. Control film for detection of radio-opaque calculi.
2. At 5 minutes post contrast for determination of functional status of the kidney.
3. According to the level of obstruction, one view was taken. For upper third of the urinary tract, at 10-12 minutes, for middle third at 18-20 minutes, for lower third at 25-28 minutes.

No post void or other routine sequence films were taken. This significantly reduced the radiation dose in patients.

Thereafter the patients underwent CT urography at our department. To reduce the nephrotoxicity from multiple contrast enhanced procedure, only 50 ml of contrast media was used. The scanning was done in three phases--Unenhanced, nephrographic and excretory phase. In all phases volume scanning was done in MDCT scanner. Nephrographic phase was obtained after 100 seconds of contrast administration and excretory phase was taken at 12-15 minutes after contrast injection. The scan area selected was from the lung base to the lower border of symphysis pubis. The source images were reformatted and analysed using the Aquarius iNutrition viewer. The reformatted images had a slice thickness of 1mm. For delineation of the urinary tract, MIP image and volume rendered images were reconstructed from the source images.

All the findings were recorded in the predesigned proforma and later compiled into the grand chart from which the data for statistical analysis was done. Latest version of SPSS software was used for the statistical analysis.

#### IV. Results & Discussions

Among the 61 patients, 42.62% were male and 57.38% were female. The male to female ratio was 1:1.34. The age of the patients ranged from 8 to 88 years, with mean age being approximately 39 years. 37.7% of the patients were in the age group 20-40 years followed by 29.5% patients in the 41-60 age group. Among the 61 patients in the study, 83.7% showed presence of calculi in CT urography, while 16.4% showed no calculi.

**Table no. 1:** Distribution of cases according to the detection of calculi in CT urography

Calculi detected in CT urography	No. of cases	percentage
Present	51	83.6
Absent	10	16.4
Total	61	100

In case of Sonographically tailored IVU, 78.7% of the patients showed the presence of calculi and the rest 21.3% did not. Among the 51 patients with calculi detected in CT urography, 72.55% had unilateral calculi and 27.45% had bilateral calculi. Considering the CT urography as the gold standard, the calculated Sensitivity, Specificity, positive predictive value, negative predictive value and accuracy of Somographically tailored IVU in detection of urinary tract calculi in urolithiasis were 90.19%, 80%, 95.83%, 61.53%, 88.5% respectively.

**Table no. 2:** Distribution of cases according to the detection of calculi in sonographically tailored IVU

Calculi detected in Sonographically tailored IVU	No. of Cases	percentage
Present	48	78.7
Absent	13	21.3
Total	61	100

Among the 48 patients with positive findings of urolithiasis in Sonographically tailored IVU, 75% had unilateral calculi and the rest 25% had bilateral calculi.

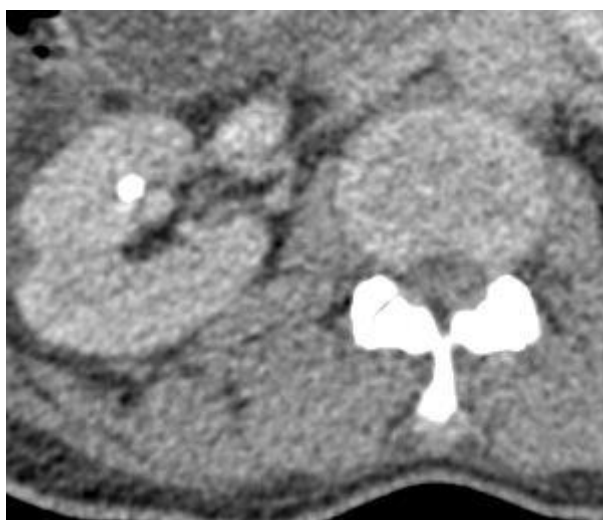
With respect to the number of the calculi detected in the study, 68.63% patients showed single calculi in CT urography , and 31.37% had multiple calculi. In case of Sonographically tailored IVU, 70.83% were found to have single calculi and 29.17% had multiple calculi.

Among the cases of urolithiasis detected in CT, 35.29% were in the range of >5 to 10 mm in size, followed by 33.33%, in the range of 2 to 5mm. In sonographically tailored urography, the most prevalent among the 48 cases of calculi were in the range of >5 to 10mm, followed by 29.17% cases having calculi in the range of 2 to 5mm.

The most prevalent location of calculi in CT urography was calyces with 43.14% cases having calculi within calyces. This was followed by 17.65% prevalence of calculi within the pelvis and in multiple locations. The least common location were urinary bladder and vesico-ureteric junction and ureter both having 3.92% prevalence. In case of sonographically tailored IVU the most prevalent location for calculi was calyces, in 45.83% cases. This was followed by 20.83% cases where calculi were located in multiple location.

Hydronephrosis was detected in 20 out of 61 cases in CT urography, which was around 32.79%, while 17 patients were found to have hydronephrosis in sonographically tailored IVU, which was approximately 27.87%. Considering CT urography as the gold standard, the calculated sensitivity, specificity, positive predictive value, negative predictive value and accuracy of sonographically tailored IVU were 75%, 95.12%, 88.23%, 88.63%, 88.52% respectively.

In 9 cases findings other than urolithiasis causing obstructing uropathy was found in CT urography. Sonographically tailored IVU was able to diagnose only 6 of those cases successfully.



**Figure 1:** Calculus seen within the calyx

## V. Conclusions

Even though it is inferior to CT urography, sonographically tailored IVU, has high sensitivity and positive predictive value in detection of urolithiasis which makes it a competent replacement of CT urography in a country like India, where resources are limited. Not only that, it also poses less radiation hazard to the patients, thus increasing its cost benefit ratio.

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