

EVALUATION AND COMPARISON OF DOPPLER SONOGRAPHY IN CASES OF ACUTE RENAL OBSTRUCTION AND ROLE OF INTRAVENOUS UROGRAPHY?

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ABSTRACT

Background: Renal colic disease is among the most frequent presentation in urologic practice. Urolithiasis is the most common cause of renal obstruction and reported frequently. The presentation of renal obstruction is more prevalent among males, approximately 6% and around 5% in females. There are published case reports of devastating effects on urinary tract structure because of renal obstruction due to urolithiasis. **Material & Methods:** The present case-control study was conducted at Department of Radiodiagnosis of our tertiary care hospital. Patients presenting to the emergency department with symptoms suggestive of acute unilateral renal colic were enrolled for the study. The kidney on the side of obstruction was taken as case kidney and the healthy contralateral kidney taken as the control. All study participants were subjected to USG, IVU, and Doppler USG using a 3.5 to 5 MHz transducer. **Results:** In the present study, 120 patients were enrolled, out of them 82 were males, and 38 were females. The mean age of males was 34.22 ± 5.68 years, which is nearly similar to the mean age of females 33.61 ± 7.48 years. This difference between age groups was statistically non-significant. The mean resistivity index (RI) was found to be higher in obstructed kidneys in all study participants. The delta RI, i.e., the difference in RI of obstructed and healthy contralateral kidney was ranged from 0.03 to 0.14 with a mean delta of 0.075. Most of the study participants (58%) were assessed between 6-12 hours, 24% patients within 13-18 hours, and 18% patients within 19-24 hours after the onset of symptoms. RI values were nearly similar in all three groups, and their difference was statistically non-significant. **Conclusion:** Doppler sonography was a better diagnostic tool for unilateral acute renal obstruction, with RI values being statistically significantly higher in complete obstruction than partial obstruction. the overall sensitivity of Doppler sonography was 92%, and specificity reported to be 94%.

Keywords: Acute renal obstruction, Doppler sonography, Complete obstruction, Partial obstruction

INTRODUCTION

The renal colic disease is among the most frequent presentation in urologic practice. Urolithiasis is the most common cause of renal obstruction and reported frequently (1). The presentation of renal obstruction is more prevalent among males, approximately 6% and around 5% in females. There are reported case reports of devastating effects on urinary tract structure because of

renal obstruction due to urolithiasis (2). To reduce the incidence of any devastating effects, it is necessary to diagnose the obstruction as early and accurately. Ultrasonography is among the routinely used diagnostic modality in the screening of renal obstruction. It helps in diagnosis by detecting proximal dilatation of urinary system before the level of obstruction. However, USG

fails to differentiate between obstructive cause and nonobstructive cause of dilatation (3). Results were also reported equivocal in cases of early renal obstruction without any significant dilatation, and also it does not show any useful data of obstruction. Although it was reported in many previous researches that its sensitivity was 90%, but specificity was only 65-85% in the diagnosis of renal obstruction (4).

Plain abdominal X-ray has reported low sensitivity in the diagnosis of renal obstruction. Intrarenal duplex Doppler ultrasonography has been introduced as a better diagnostic tool as it is a non-invasive technique and able to differentiate between obstructive and nonobstructive urinary system dilatation, which is not achieved by USG (5). Intrarenal duplex Doppler ultrasonography detects the change in renal hemodynamics, which mediated by vasoactive mediators because of obstruction (6). Findings reported as elevated RI of the obstructed kidney is elevated in comparison of normal contralateral kidney, and this difference in RI of both kidneys is measured as delta RI (7).

Although intravenous urography is still used as the diagnostic modality, it has reported limitations (8). The aim of the present study to evaluate and compare the Doppler ultrasonography in cases of acute renal obstruction with the normal contralateral kidney. We also reported the effect of degree and site of renal obstruction and timing of the Doppler ultrasonographic evaluation after the onset of symptoms.

MATERIALS & METHODS

The present case-control study was conducted at Department of radiodiagnosis of our tertiary care hospital. The study duration was of one year from September 2017 to August 2018. A sample size of 120 was calculated at 95% confidence interval at 10% acceptable margin of error by epi info software version 7.2. Patients presenting to the emergency department with symptoms suggestive of acute unilateral renal colic were enrolled for the study. The kidney on the side of obstruction was taken as case kidney, and the normal contralateral kidney was chosen as the control. Clearance from Institutional Ethics Committee was taken before the start of the study. Written informed consent was taken from each study participant. All study

participants were subjected to USG, IVU, and Doppler USG using a 3.5 to 5 MHz transducer.

Intravenous urography was used to detect the degree and site of renal obstruction. If the obstruction was proximal to the L3 vertebral level, it was considered as proximal obstruction and distal, if beyond the L3 vertebral level. In cases with delayed excretions of contrast material degree of obstruction taken as complete and in cases with prompt excretion of contrast degree of obstruction taken as partial. Non dilated PCS, and dense nephrogram on intravenous urography was excluded from the study.

Three Doppler spectrum were taken using the lowest possible wall filter from interlobar arteries running on the margin of the medullary pyramids. By using Doppler, sample width was set at 2-5 mm, and the lowest pulse repetition frequency without aliasing Doppler waveforms was created. This was done to enhance the Doppler spectrum and reduce the bias of the study. The renal RI was calculated by the formula: $(\text{Peak systolic velocity} - \text{end diastolic velocity})/\text{peak systolic velocity}$. the difference in RI of both kidneys is measured as delta RI. Data analysis was carried out using SPSS v22. All tests were done at alpha (level significance) of 5%; means a significant association present if the p-value was less than 0.05.

RESULTS

In the present study, 120 patients were enrolled, out of them, 82 were males, and 38 were females. The mean age of males was 34.22 ± 5.68 years, which is nearly similar to the mean age of females 33.61 ± 7.48 years. This difference between age groups was statistically non-significant. The mean resistivity index (RI) was found to be higher in obstructed kidneys in all study participants. The delta RI, i.e., the difference in RI of obstructed and normal contralateral kidney was ranged from 0.03 to 0.14 with a mean delta of 0.075. Most of the study participants (58%) were assessed between 6-12 hours, 24% patients within 13-18 hours, and 18% patients within 19-24 hours after the onset of symptoms. RI values were nearly similar in all three groups, and their difference was statistically non-significant. (Table 1)

Table 1: Distribution of study participants according to the relationship of resistivity indices with the duration of obstruction.

RI Values	6-12 hours (n =58%)	13-18 hours (n= 24%)	19-24 hours (n= 18%)	P value
Obstructed kidney	0.73±0.01	0.72±0.01	0.73±0.01	>0.05
Unobstructed kidney	0.63±0.01	0.64±0.01	0.63±0.02	>0.05
Delta RI	0.09±0.01	0.08±0.02	0.09±0.02	>0.05

In the present study, the site of obstruction was proximal in 54 (45%) patients and distal in 66 (55%) patients. The mean RI of the obstructed kidneys, which was proximally obstructed, was higher (0.73±0.01). However, this difference was statistically non-significant. Out of 120 study participants, 64 patients show obstruction of the right kidney, and 56 patients had obstruction of the left kidney. Out of 64 obstructed right kidneys, 29 (45.3%) patients had a proximal obstruction, and 35 (54.7%) patients had distal obstruction. Out of 56 obstructed left kidneys 25 (44.6%) patients had proximal, and 31(55.4%) patients had distal obstruction. (Table 2)

In the present study, out of total patients, 96 patients had a complete obstruction, while 24 patients had partial obstruction. RI value in completely obstructed kidneys was 0.73 versus 0.71; p<0.05. However, even in partially obstructed kidneys, this difference was statistically non-significant. (Table 3). In the present study, we found that the overall sensitivity of Doppler sonography was 92%, and specificity reported to be 94%. In patients who had a complete renal obstruction, the sensitivity was 96% while specificity was 96%. In patients who had a partial renal obstruction, the sensitivity reduced to 87% specificity reduced to 92%.

Table 2: Distribution study participants according to resistivity indices with the site of obstruction.

	Mean RI of Proximal obstruction	Mean RI of normal on other side	Delta RI
Both kidneys	0.73±0.01	0.63±0.02	0.09
Left kidney	0.74±0.01	0.64±0.02	0.09
Right kidney	0.72±0.02	0.62±0.03	0.09

Table 3: Distribution study participants according to resistivity indices with the degree of obstruction

RI Values	Complete	Partial	P-value
Obstructed kidney (RI)	0.73±0.01	0.71±0.01	< 0.05
Unobstructed kidney (RI)	0.63±0.02	0.62±0.02	> 0.05
Delta RI	0.09±0.01	0.08±0.01	> 0.05

DISCUSSION

Acute unilateral ureteric obstruction leads to complex sequelae of changes in ureteric pressure and renal blood flow (9). However, ultrasonography provides only indirect evidence of the proximal dilatation due to renal obstruction. Therefore, a more direct and 'functional' basis of the diagnosis of renal obstruction is required for treatment initiation. Hence, Doppler sonographic techniques have been introduced to obtain the basis of functional diagnosis in suspected cases of renal obstruction (10).

In the present study, 120 patients were enrolled, out of them 82 were males, and 38 were females. The mean age of males was 34.22±5.68 years, which is nearly similar to the mean age of females 33.61±7.48 years. This difference between age groups was statistically non-significant. The mean resistivity index (RI) was found to be higher in obstructed kidneys in all study participants. The delta RI, i.e., the difference in RI of obstructed and normal contralateral kidney was ranged from 0.03 to 0.14 with a mean delta of 0.075. Most of the study participants (58%) were assessed between 6-12 hours, 24% patients within 13-18 hours, and 18% patients within 19-24 hours after the onset of symptoms. RI values were nearly similar in all three groups, and their difference was statistically non-significant.

In a study conducted by Rodgers et al. among patients of renal colic assessed by Doppler sonography and reported that mean resistance index (RI) of the obstructed kidneys was significantly higher than the normal kidneys. The mean difference between the RIs of the obstructed kidneys and their contralateral normal kidneys was also significantly greater than the differences in RI seen between pairs of normal kidneys (11). Similar results were reported in a study conducted by Platt et al. among patients of acute unilateral renal

obstruction and found that RI of the obstructed kidneys was significantly greater than the normal kidneys (12). Another study conducted by Tublin et al. reported that the delta RI for the patients of acute unilateral renal obstruction were statistically significant. They also reported that doppler alone was not found to highly sensitive in diagnosing the renal obstruction (13).

In the present study, the site of obstruction was proximal in 54 (45%) patients and distal in 66 (55%) patients. The mean RI of the obstructed kidneys, which was proximally obstructed, was higher (0.73 ± 0.01). However, this difference was statistically non-significant. Out of 120 study participants, 64 patients show obstruction of the right kidney, and 56 patients had obstruction of the left kidney. Out of 64 obstructed right kidneys, 29 (45.3%) patients had a proximal obstruction, and 35 (54.7%) patients had distal obstruction. Out of 56 obstructed left kidneys 25 (44.6%) patients had proximal, and 31(55.4%) patients had distal obstruction. Out of total patients, 96 patients had a complete obstruction, while 24 patients had partial obstruction. RI value in completely obstructed kidneys was 0.73 versus 0.71; $p < 0.05$. However, even in partially obstructed kidneys, this difference was statistically non-significant. Similar results to the present study were reported in a study conducted by Shokier et al., who stated that renal Doppler sonography was sensitive and highly specific in the diagnosis of acute unilateral renal obstruction (14).

In the present study, we found that the overall sensitivity of Doppler sonography was 92%, and specificity reported to be 94%. In patients who had a complete renal obstruction, the sensitivity was 96% while specificity was 96%. In patients who had a partial renal obstruction, the sensitivity reduced to 87% specificity reduced to 92%. A study conducted by Toledo et al. reported that the overall sensitivity of Doppler sonography was 92%, and specificity said to be 93% (15).

CONCLUSION

We concluded from the present study that Doppler sonography was a better diagnostic tool for unilateral acute renal obstruction, with RI values being statistically significantly higher in complete obstruction than partial obstruction. the overall sensitivity of Doppler

sonography was 92%, and specificity reported to be 94%.

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Fig. 1 Lt Ureteric obstruction RI

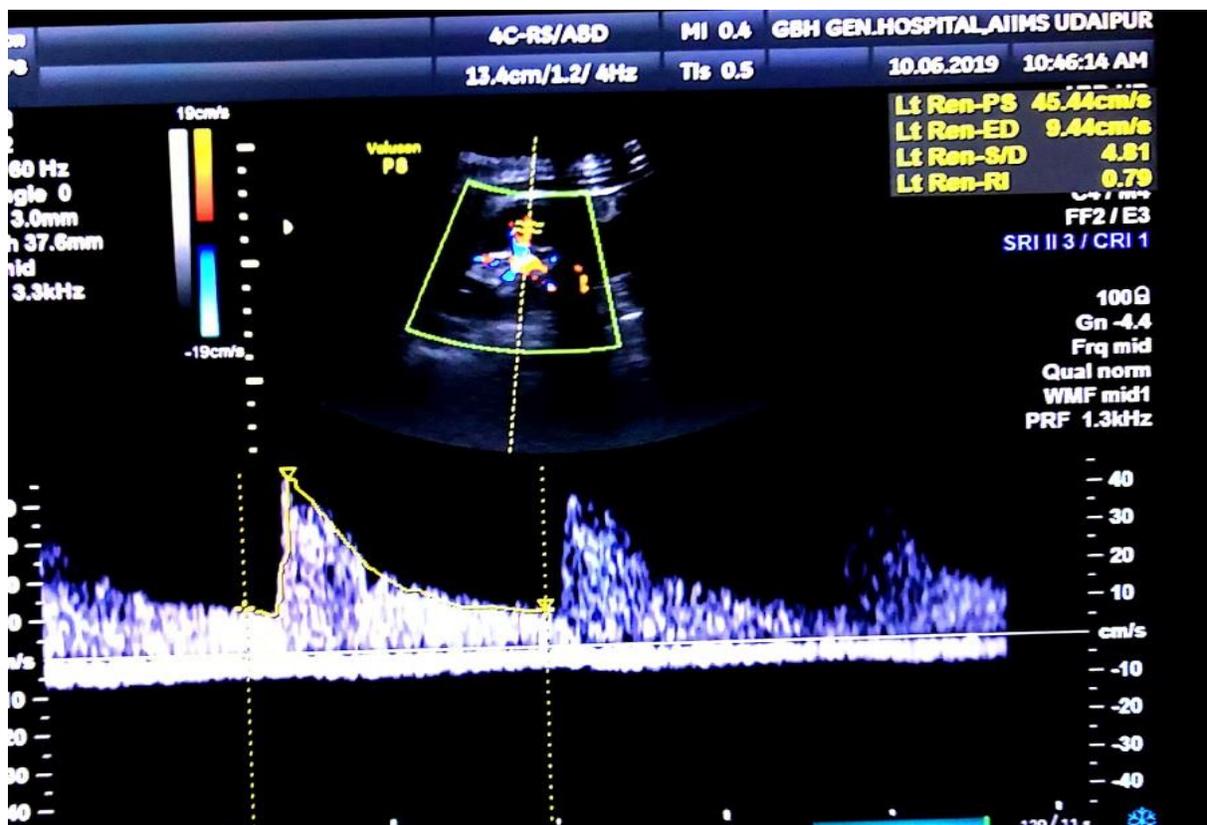


Fig: 2. RI in normal Kidney

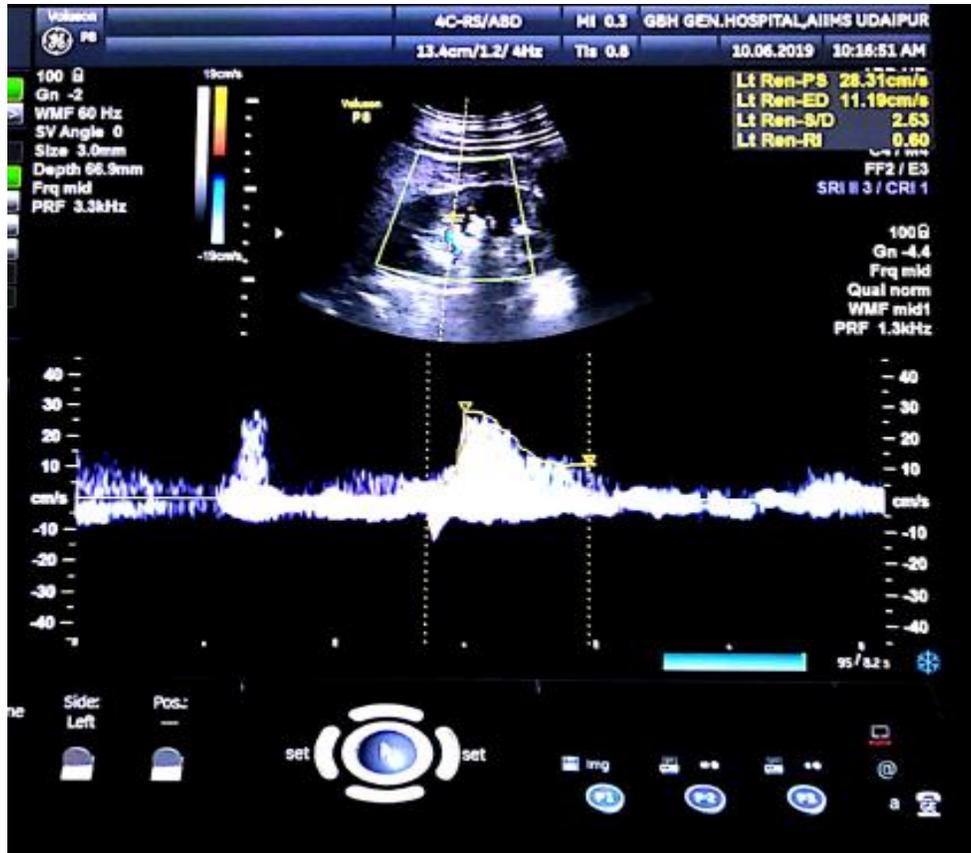


Fig :3. Rt ureteric obstruction

