

## EVALUATION OF ACUTE RENAL OBSTRUCTION BY USING DOPPLER SONOGRAPHY

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### ABSTRACT

**Background:** Acute renal obstruction is the most common presenting condition observed in inpatient departments as well as in outpatient departments. Unilateral obstruction is more common than bilateral obstruction and resultant for minimal change in patient's renal function, but in the bilateral obstruction, cases show deteriorate renal functions although it is less common. **Methods:** All the cases which were presented to the emergency department with unilateral acute renal colicky pain within 24h of onset of symptoms were considered for this analysis. A total of 50 patients who had unilateral acute renal obstruction were enrolled for study by simple random sampling. Hence we had 50 healthy kidneys which were served as controls and 50 obstructed kidneys which were served as cases. **Result:** The mean resistivity index (RI) was reported, and it was found higher in the cases with obstructed kidneys diseases compared to unobstructed kidneys. In 56% of the cases, evaluation was done between 6-12 hours, within 13-18 hours in 24% of cases and within 19-24 hours in 20%. The mean resistivity index of the obstructed kidney diseases with proximal obstruction was found to be higher ( $0.70 \pm 0.02$ ), than with the distal obstruction ( $0.68 \pm 0.02$ ). The mean resistivity index value incomplete renal obstruction ( $0.71 \pm 0.02$ ) was statistically higher than partial renal obstruction ( $0.68 \pm 0.02$ ). **Conclusion:** Doppler ultrasound was the better diagnostic modality for the acute unilateral renal obstruction and even detects an obstruction when there were negative USG results.

**Keywords:** Doppler ultrasound, resistivity index, acute renal obstruction.

### INTRODUCTION

There are several diagnostic techniques and treatment procedures are available nowadays for the accurate diagnosis and prompt management of acute renal obstruction. These are radiographic procedures such as the plain film x-rays, ultrasonography, Doppler sonography, retrograde urography, intravenous urography, computed tomography (CT), magnetic resonance (MR) urogram (1). Criteria of selecting the procedure of choice depend on several factors,

for example, patient's age, renal function, and acuity of obstruction along with these considerations for reliability and cost of the test also taken in account (2). Acute renal obstruction is the most common presenting condition observed in inpatient departments as well as in outpatient departments. Unilateral obstruction is more common than bilateral obstruction and resultant for minimal change in patient's renal function, but in the bilateral obstruction, cases

show deteriorate renal functions although it is less common (3).

From a very long time, USG is the most common procedure used for at first for the detection and initial evaluation of acute renal obstruction. It provides the indirect basis of diagnosis by detecting the urinary system dilatation before the level of renal obstruction, with the sensitivity of 90% and specificity of 80%(4). Doppler USG has also been used for the diagnosis of acute renal obstruction. Doppler USG provided detailed information about intrarenal blood flow changes and even details of renal pathophysiologic conditions. Doppler USG has the advantage in detecting obstructive and non-obstructive urinary system dilatation and differentiating them(5).

Doppler sonography has an additional advantage of being radiation safe, and it can be employed when we can't tolerate the radiation risk for example in pregnant patients. The mean resistivity index (RI) value shows the level of impedance in renal blood flow, and it usually rose when the obstruction is present in the urinary system(6). In various researches, the mean resistivity index in the presence of acute renal obstruction was found to be higher than 0.70, and the mean resistivity index difference between both kidneys was found to be higher than 0.10(7). The present study aimed to evaluate the acute renal obstruction with the help of Doppler sonography and compare the function of the obstructed kidney with another healthy kidney.

## **MATERIALS & METHODS**

The present observational study was conducted at our tertiary care hospital in the department of radio-diagnosis. All the cases which were presented to the emergency department with unilateral acute renal colicky pain within 24h of

onset of symptoms were considered for this analysis. A total of 50 patients who had unilateral acute renal obstruction were enrolled for study by simple random sampling. Hence we had 50 healthy kidneys which were served as controls and 50 obstructed kidneys which were served as cases. Clearance from Institutional Ethics Committee was taken before the start of the study and written informed consent for the study purpose was obtained from all the enrolled participants. All the patients were subjected to a pretested proforma and socio-demographic data were recorded along with detailed general physical and clinical examination. Evaluation of pelvicalyceal system dilatation was done in both kidneys by the gray-scale images. For every case, minimum three spectra were taken by Doppler sonography from interlobar arteries corresponding to the border of medullary pyramids. To maximize the size of the spectrum and to reduce the margin of error we used the low pulse repetitive frequency doppler waveforms. Sample width for Doppler was fixed at 2-5mm, and wall filter at minimum possible was used for each scanner. Mean Resistivity Index was calculated for each kidney. The data were analyzed by using software's MS Excel 2010, Epi Info v7 and SPSS v22.

## **RESULTS**

In the present study out of the 50 patients, 34 were males, and 16 were females. The mean age of the men was  $32.48 \pm 14.12$  years, and it was lower than the mean age of women, which was  $33.76 \pm 15.39$  year. However, this difference was statistically not significant. The mean resistivity index (RI) was reported, and it was found higher in the cases with obstructed kidneys diseases compared to unobstructed kidneys. In 56% of the cases, evaluation was done between 6-12 hours, within 13-18 hours in 24% of cases and within 19-24 hours in 20% after the appearance of

symptoms. However, there was no statistically significant association was found in all three groups. (Table 1).

**Table 1: Relationship of resistivity index with obstruction and its duration.**

RI Values	6-12 hours (n = 28)	13-18 hours (n = 12)	19-24 hours (n = 10)	P value
Obstructed kidney (RI)	0.68±0.02	0.69±0.02	0.68±0.02	NS
Unobstructed kidney (RI)	0.62±0.02	0.61±0.02	0.61±0.02	NS
Delta RI	0.06±0.02	0.07±0.02	0.07±0.02	NS

In the present study, the site of obstruction was found proximal in 34 (68%) cases and distal in 16 (32%) cases. The mean resistivity index of the obstructed kidney diseases with proximal obstruction was found to be higher (0.70 ±0.02), than in the obstructed kidney diseases with distal obstruction (0.68 ± 0.02). However, there was no statistically significant association was found in both the groups. (Table 2)

**Table 2: Relationship of resistivity index with the site of obstruction.**

RI Values	Proximal	Distal	P value
Obstructed kidney (RI)	0.70±0.02	0.68±0.02	NS
Unobstructed kidney (RI)	0.64±0.01	0.62±0.01	NS
Delta RI	0.07±0.01	0.06±0.01	NS

In the present study, it was reported that 32 (64%) patients had a complete renal obstruction, while 18 (36%) cases had a partial obstruction. The mean resistivity index value incomplete renal obstruction (0.71 ±0.02) was higher than partial renal obstruction (0.68 ±0.02). This difference was found to be statistically significant. However, among the cases of partial

renal obstruction, mean resistivity index value was also significantly higher than the unobstructed (contralateral) kidney. (Table 3)

**Table 3: Relationship of resistivity index with the nature of obstruction.**

RI Values	Complete	Partial	P value
Obstructed kidney (RI)	0.71±0.02	0.68±0.02	<0.05
Unobstructed kidney (RI)	0.63±0.01	0.61±0.01	NS
Delta RI	0.06±0.01	0.06±0.01	NS

## DISCUSSION

Acute unilateral renal obstruction was responsible for changes in ureteric pressure and renal blood flow and may present as a complex sequence of morbidities(8). The diagnostic procedures such as ultrasonography provide only indirect evidence of the acute unilateral obstruction, but for the more detailed and direct evidence or functional evaluation, we required a more advanced diagnostic approach. Hence, in the present study, we conducted a study by using Doppler ultrasound for the acute unilateral renal obstruction to finding out its efficacy and its accuracy in the diagnosis and differentiation of obstructed renal diseases. Since the Doppler ultrasound procedure has been opting in nowadays for the functional assessment in the cases of suspected acute renal obstruction (9).

In the present study out of the 50 patients, 34 were males, and 16 were females. The mean age of the men was 32.48±14.12years, and it was lower than the mean age of women, which was a 33.76±15.39 year. However, this difference was statistically not significant. The mean resistivity index (RI) was reported, and it was found higher in the cases with obstructed kidneys diseases compared to unobstructed kidneys. In 56% of the cases, evaluation was done between 6-12 hours, within 13-18 hours in 24% of cases and within 19-24 hours in 20% after the appearance of symptoms. However, there was no statistically significant association was found in all three

groups. In a study conducted by Rodgers et al. reported that Higher Resistivity Index in the cases of renal obstructed, when it as compared with the contralateral kidneys and also with the healthy control group (10). Similar study results were also reported by a study conducted by Platt et al. among patients with acute unilateral renal obstruction and informed the sensitivity of the Doppler ultrasound. However, the findings were significantly not associated with the other diagnostic modalities (11). In another study conducted by Tublin et al. among patients with acute unilateral renal obstruction and reported that Doppler ultrasound was significantly not associated with the other diagnostic modalities in the diagnosis of obstruction of the kidneys (12).

In the present study, the site of obstruction was found proximal in 34 (68%) cases and distal in 16 (32%) cases. The mean resistivity index of the obstructed kidney diseases with proximal obstruction was found to be higher ( $0.70 \pm 0.02$ ), than in the obstructed kidney diseases with distal obstruction ( $0.68 \pm 0.02$ ). However, there was no statistically significant association was found in both the groups. Similar results were found in a study conducted by Platt et al. among the patients with acute renal obstruction and stated that the mean resistivity index of the obstructed kidney diseases with proximal obstruction was found to be higher than the distal obstruction (13). A study conducted by Shokier et al. among the patients with acute renal obstruction also found nearly similar results and reported that the mean resistivity index of proximal obstruction was found to be higher than the distal obstruction in the obstructed kidney disease (14).

In the present study, it was reported that 32 (64%) patients had a complete renal obstruction, while 18 (36%) cases had a partial obstruction. The mean resistivity index value incomplete renal obstruction ( $0.71 \pm 0.02$ ) was higher than partial renal obstruction ( $0.68 \pm 0.02$ ). This difference was found to be statistically significant. However, among the cases of partial renal obstruction, Mean Resistivity Index value was also significantly higher than the unobstructed (contralateral) kidney. Similar

results were found in a study conducted by Toledo et al. among the patients with acute renal obstruction and stated that the mean resistivity index of the obstructed kidney diseases with complete obstruction was found to be higher than the partial obstruction (15).

## CONCLUSION

We concluded from the present study that Doppler ultrasound was the better diagnostic modality for the acute unilateral renal obstruction and even detect an obstruction when there were negative USG results. The resistivity index value with proximal obstruction was higher than the distal obstruction and mean RI value in patients with complete obstruction was significantly higher than the partial obstruction. Among the cases of partial renal obstruction, mean resistivity index value was also significantly higher than the unobstructed (contralateral) kidney.

## REFERENCES

1. Saboo S, Soni S, Saboo S, Chinapuvvula N, Kaza S. Doppler sonography in acute renal obstruction. *Indian J Radiol Imaging*. 2007;17(3):188.
2. Sayani R, Ali M, Shazlee K, Hamid RS, Hamid K. Functional evaluation of the urinary tract by duplex Doppler ultrasonography in patients with acute renal colic. *Int J Nephrol Renovasc Dis*. 2012;5:15–21.
3. Nagvekar RA, Nagvekar P. Doppler sonography in acute renal obstruction and role of intravenous urography : a study in a tertial care centre. 2017;4(1):23–6.
4. C.D. A, R.A. O. Imaging in urinary tract obstruction. *Brazilian J Urol*. 2001;27(4):316–25.
5. Viazzi F, Leoncini G, Derchi LE, Pontremoli R. Ultrasound Doppler renal resistive index: a useful tool for the management of the hypertensive patient. *J Hypertens*. 2014 Jan;32(1):149–53.

6. Barozzi L, Valentino M, Santoro A, Mancini E, Pavlica P. Renal ultrasonography in critically ill patients. *Crit Care Med* . 2007 May;35:198–205.
7. Raza RH, Yasir K, Muhammad U, Tariq A, Mohammad S. The usefulness of inter-renal resistive index difference in diagnosing acute unilateral ureteric obstruction due to calculus. *PAFMJ*. 2009;59(2):21–7.
8. Amit JU, Indira N, Suresh A, Ramprakash H V. Renal Arterial Doppler in Acute Ureteric Obstruction: A Prospective Study. 2015;3(8):6–10.
9. Spatola L, Andrulli S. Doppler ultrasound in kidney diseases: a key parameter in clinical long-term follow-up. *J Ultrasound*. 2016 Dec;19(4):243–50.
10. Rodgers PM, Bates JA, Irving HC. Intrarenal Doppler ultrasound studies in normal and acutely obstructed kidneys. *Br J Radiol*. 1992 Mar;65(771):207–12.
11. Platt JF, Rubin JM, Ellis JH. Acute renal obstruction: evaluation with intrarenal duplex Doppler and conventional US. *Radiology*. 1993 Mar;186(3):685–8.
12. Tublin ME, Dodd GD, Verdile VP. Acute renal colic: diagnosis with duplex Doppler US. *Radiology*. 1994 Dec;193(3):697–701.
13. Platt JF, Ellis JH, Rubin JM. Role of renal Doppler imaging in the evaluation of acute renal obstruction. *Am J Roentgenol*. 1995 Feb;164(2):379–80.
14. Shokeir AA, Abdulmaaboud M. Resistive index in renal colic: a prospective study. *BJU Int* . 1999 Mar;83(4):378–82.
15. de Toledo LS, Martínez-Berganza Asensio T, Cozcolluela Cabrejas R, de Gregorio Ariza MA, Pardina Cortina P, Ripa Saldias L. Doppler-duplex ultrasound in renal colic. *Eur J Radiol* . 1996 Sep;23(2):143–8.