ORIGINAL ARTICLE

DIAGNOSTIC ACCURACY OF INTRARENAL RESISTIVE INDEX TO DIFFERENTIATE ACUTE OBSTRUCTIVE UROPATHY FROM NON-OBSTRUCTIVE UROPATHY TAKING INTRAVENOUS UROGRAM AS GOLD STANDARD

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ABSTRACT

INTRODUCTION: Renal obstruction is the most common problem in the urology world today. Urolithiasis causing acute renal obstruction is the most frequent cause. Early and accurate diagnosis can overcome the deteriorating effects of obstruction on the urinary tract. Computed tomography pyelogram now a day is considered to be the gold standard investigation for urolithiasis. For assessment of acute renal colic, plain abdominal radiography, Ultrasound, and Intravenous urography are used as first-line diagnostic tools. Doppler and conventional Ultrasound are modalities of choice in patients with renal colic. Conventional Ultrasound alone cannot readily distinguish an obstructed from a non-obstructed dilated renal collecting system, whereas with the help of Doppler ultrasound using a resistive index to quantify changes in intrarenal arterial Doppler ultrasound waveforms, it results in increasing the diagnostic accuracy of ultrasound in patients with urinary obstruction. **MATERIAL AND METHODS:** This was a cross-sectional study conducted at the Radiology department of a tertiary care hospital. A total of 100 patients with the complaint of acute unilateral flank pain with suspicion of acute obstructive uropathy was included in this study. The patient s Doppler ultrasound was done. Mean intrarenal RI and difference in mean RI of the obstructed and contralateral kidneys (ΔRI) were calculated and patients were labeled as positive or negative. This is followed by Intravenous urography. SPSS version 20 was used for data entry and analysis. **RESULTS:** The mean age of the patients was 31.90 – 6.12 years. There were 87 patients whose IVU was positive whereas Doppler ultrasound findings were positive in 85 patients. The sensitivity and specificity of Doppler ultrasound were 97.7% and 100%. While PPV and NPV of Doppler ultrasound were 100% and 86.67% respectively. **CONCLUSION:** Intra renal resistive index on Doppler ultrasound is a useful diagnostic tool that can be effectively used to differentiate acute obstructive uropathy from non-obstructive uropathy with the sensitivity of 97.7%.

Introduction

Renal obstruction is the most common problem in the urology world today.[1] Urolithiasis causing acute renal obstruction is the most frequent cause. Early and accurate diagnosis can overcome the deteriorating effects of obstruction on the urinary tract.[2] CT pyelogram now a day is considered to be the gold standard investigation for urolithiasis.[2,3] The first line of investigation is usually an ultrasound which shows

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the stone or hydronephrosis of the collecting system. To evaluate obstructive and non-obstructive dilatation, the role of Doppler ultrasound and intrarenal resistive index (RI) has been documented.[1,4]

An elevated RI highlights considerable obstruction causing constriction of vessels.[5,6] This study showed that ΔRI measurement with Doppler ultrasound allowed to rule out the renal obstruction with a sensitivity of 93.8%, specificity of 95.0%, and an accuracy of 94.4%.[6]

Literature has well-intentioned evidence of the role of Doppler ultrasound but often urologists rely on intravenous urography which is expensive and required expertise and a special atmosphere, however, Doppler ultrasound is cheap, easily available, and does not require a special atmosphere. So, we want to do this study to prove that Doppler ultrasound is accurate enough to diagnose obstruction and also to reduce the financial burden of the examination on the institute and to decrease in radiation dosage. This study will also definitely be a positive addition to the available data.

Materials and Method

This was a cross-sectional study conducted at the Radiology department SIUT Karachi. Total 100 patients of age 20 to 40 years of either gender with the complaint of acute unilateral flank pain with suspicion of acute obstructive uropathy were included in the study, while patients with a complaint of flank pain but suffering from a pre-existing renal disease other than renal obstruction (through medical record) and those presenting with the complaint of bilateral flank pain were excluded from the study. Informed consent was taken from all the patients. Then patients underwent Doppler ultrasound in the supine position using a curvilinear transducer of 3.5-5 MHz. Grayscale ultrasound was done first and then doppler waveforms readings were recorded in the obstructive kidney at interlobar and arcuate arteries at multiple locations (upper, middle, and lower poles) followed by the contralateral kidney. The intrarenal RI was calculated by subtracting the peak diastolic velocity from the peak systolic velocity and dividing the result by the peak systolic velocity. Mean intra renal RI and difference in mean RI of the obstructed and contralateral kidneys (ΔRI) were determined and patients were labeled as positive or negative (as per operational definition). Then intravenous urogram examination was done for confirmation of positive cases when calculus is seen in the ureter causing proximal dilatation of calyceal system or negative cases when no calculus is noted in the ureter in the presence of the dilated calyceal system. SPSS version 20 was used to analyze the collected information. Age was presented in mean and standard deviation. Frequency and percentage were computed for categorical variables like gender and side of renal colic. Sensitivity, specificity, positive predictive value, and negative predictive value of Doppler ultrasound were calculated taking intravenous urography as the gold standard by using a 2x2 table.

Results

A total of 100 patients were included in the study with a mean age of 31.90 – 6.12 years, the minimum age was 20 years and the maximum age was 40 years. There was a total of 72 males and 28 females in our study. All patients were assessed for renal colic. Doppler ultrasound findings show that there were 85 patients who had positive findings of renal obstruction and the remaining 15 patients had negative Doppler ultrasound findings of renal obstruction. There were 87 patient s whose intravenous urogram was positive for renal obstruction and 13 patient s intravenous urogram report was negative for renal obstruction. The diagnostic accuracy of Doppler ultrasound RI was compared with the intravenous urogram. Diagnostic accuracy results showed that the sensitivity and specificity of the Doppler ultrasound resistive index were 97.7% and 100%. While positive predictive value and negative predictive value of the Doppler ultrasound resistive index were 100% and 86.67% respectively as shown in (Tab.1).

Sensitivity	Specificity	Positive Predictive Value	Negative Predictive Value
97.7%	100%	100%	86.67%

Table 1: Diagnostic accuracy of Doppler ultrasound vs intravenous urogram

Discussion

In acute renal colic, plain abdominal radiography, ultrasound, and intravenous urogram are widely used diagnostic tools. Doppler and conventional ultrasound are modalities of choice in patients with renal colic. In obstructive uropathy computed tomography pyelogram is considered the gold standard for diagnosis due to its high accuracy. Conventional ultrasound alone cannot readily distinguish an obstructed from a non-obstructed dilated renal collecting system, whereas with the help of Doppler ultrasound using a resistive index to quantify changes in intrarenal arterial Doppler ultrasound waveforms, it results in increasing the diagnostic accuracy of ultrasound in patients with urinary obstruction.[7-11] To diagnose acute unilateral renal obstruction, renal Doppler ultrasound is a highly sensitive and specific test. To calculate the resistive index and measure renal blood flow, Doppler ultrasound is the first line of choice as a diagnostic tool. The resistive index is a physiological parameter, which is measured by the ratio of peak systolic velocity and end-diastolic velocity derived from the Doppler spectrum. RI is used to measure the degree of resistance within intrarenal vessels. Previously the cut-off value of the resistive index to identify obstructive uropathy is above 0.70, above RI of 0.70 the dilation can be labeled as obstructive in origin, with a 93% sensitivity and 100% specificity.[12-14]

In a study done at a tertiary care hospital, Karachi, with a resistive index value of > 0.70 as a discriminatory level for obstruction, the overall sensitivity of the resistive index was 76.23% and specificity was 88.13%. The positive predictive values in patients with obstructive uropathy were 91.6%, and the negative predictive value was calculated to be 68.42%. The diagnostic accuracy of the test was 80%.[15] Mean RI along with sensitivity and specificity of RI more than 0.7 of obstructed kidney in literature review ranges between 75.5%-91.8% and 85%-92.8% respectively.[16,17]

Results of this study are comparable with the prior studies done showed almost the same range for sensitivity and specificity. So this technique of resistive index on Doppler ultrasound is easily available, non-invasive, painless, and relatively easy to do with no risk of radiation exposure. It is the modality of choice in patients where contrast cannot be given such as in pregnancy, contrast agent allergy, and renal dysfunction.

Conclusion

Intra renal resistive index on doppler ultrasound can differentiate acute obstructive uropathy from non-obstructive uropathy with sensitivity and specificity of 97.7% and 100% respectively.

Conflict of Interest: Declared none

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