

RENAL PARENCHYMAL DISEASE – CORRELATION OF RESISTIVE INDEX WITH BIOPSY FINDINGS

Barindranath Mallick¹, Jayanta Pal²

¹Assistant Professor, Department of Radiology, Murshidabad Medical College.

²Assistant Professor, Department of Radiology, Murshidabad Medical College.

ABSTRACT

BACKGROUND

The renal resistive index (RI), which is considered a reflection of renal parenchymal resistance, has been widely used to support diagnostic and therapeutic procedures.

OBJECTIVES

To determine renal parenchymal disease that produces increased renal vascular resistance from those which do not and for correlation of resistive index with percutaneous kidney biopsy findings.

MATERIALS AND METHODS

A prospective study was carried out for a period of 18 months in the Radiology Dept. of IPGMER, Kolkata. All the Patients with renal parenchymal disease during the study period were included, Doppler ultrasound was used to calculate RI (resistive index), and Ultrasound-guided percutaneous kidney biopsy was done to obtain the findings. Data was entered in Excel sheet and sensitivity, specificity, positive predictive value, negative predictive value, accuracy and Z test was applied.

RESULTS

Among the 50 study subjects, 50% were males and the rest were females. Sensitivity, specificity and accuracy was high for tubulointerstitial disease as compared to glomerular disease. Z-test also showed significant difference between the two groups.

CONCLUSION

In conclusion, duplex Doppler sonography would seem to detect a state of increased vascular resistance (elevated RI) in some forms of renal parenchymal disease but not in others.

KEYWORDS

Renal Parenchymal Disease, RI, Biopsy, Sensitivity, Specificity.

HOW TO CITE THIS ARTICLE: Mallick B, Pal J. Renal parenchymal disease – correlation of resistive index with biopsy findings. J. Evid. Based Med. Healthc. 2016; 3(58), 3074-3076. DOI: 10.18410/jebmh/2016/669

INTRODUCTION: Renal parenchymal disease is the most common cause of secondary hypertension, accounting for 2.5% to 5.0% of all cases. Hypertension associated with renal parenchymal disease occurs as a complication of a wide variety of glomerular and interstitial renal diseases and may accelerate the decline in renal function if inadequately controlled.¹ Hence, early diagnosis and treatment is of prime importance in those conditions. However, the most common investigation used for the diagnosis is ultrasound which fails to identify the glomerular pathology at the early stage as glomerular component accounts only for 8% of the renal parenchyma.²

Percutaneous kidney biopsy is an important technique in clinical nephrology, which is the gold standard to diagnose and locate the primary abnormality as within the glomerulus, the interstitium or within the vascular compartment in renal parenchymal disease.³

Financial or Other, Competing Interest: None.

Submission 24-06-2016, Peer Review 30-06-2016,

Acceptance 14-07-2016, Published 21-07-2016.

Corresponding Author:

Dr. Barindranath Mallick,

#22/1, Sugam Apartment, Flat No. 4A,

Gorachand Road, Kolkata-700014.

E-mail: drbarinm@gmail.com

DOI: 10.18410/jebmh/2016/669

Recently, Doppler waveforms of intrarenal arterial blood flow have been extensively investigated to determine physiologic and pathologic correlations. Among the parameters introduced, the renal resistive index (RI), which is considered a reflection of renal parenchymal resistance, has been widely used to support diagnostic and therapeutic procedures.⁴

In view of the paucity of research activity in India in this common yet unexplored field, the present study has been designed to determine the correlation of resistance index with biopsy findings in patients using Doppler ultrasound.

OBJECTIVES: To determine renal parenchymal disease that produces increased renal vascular resistance from those which do not and for correlation of resistive index with percutaneous kidney biopsy findings.

MATERIALS AND METHODS: A prospective study was carried out for a period of 18 months (February 2009- July 2010) in the Radiology and Nephrology Dept., SSKM Hospital, IPGMER, Kolkata. All the patients with renal parenchymal disease referred to the Dept. of Radiology for

Ultrasound-guided percutaneous kidney biopsy during the study period were included. Those patients who were declared unfit for percutaneous kidney biopsy like abnormal coagulation profile, small contracted kidney, etc. and those with equivocal results in histopathological findings like more than one disease process evident in biopsy specimen were excluded from the study.

Spectral analysis and resistive index was measured at least three times in each kidney and the Mean RI values will be calculated from all measurements to avoid misdiagnosis. Resistive index changes will be evaluated in a separate data sheet for each patient, which is measured by the formula $RI = (\text{Peak systolic frequency shift} - \text{minimum diastolic frequency shift} / \text{Peak systolic frequency shift})$. An ultrasound-guided renal biopsy was conducted and was sent to histopathology section.

The data was entered in Excel sheet and Standard statistical method i.e. sensitivity, specificity, positive predictive value, negative predictive value, accuracy and test of significance were used to analyse the study results.

RESULTS: Total 75 patients were initially included in the study. Followup of only 50 patients was available. Rest of the cases were dropped out either due to patients declared unfit for percutaneous kidney biopsy like abnormal coagulation profile, small contracted kidney etc. (in 5 cases), or inability of followup due to lack of communication with the patient (in 10 cases), and patients with equivocal results in histopathological findings like more than one disease process evident in biopsy specimen (in 10 cases).

Among the study subjects, 25 were males and 25 of them were females. Majority of them were in the age group 21-30 years (32%), followed by 41-50 years (20%).

	RI	
Hypertension	Positive	Negative
Present	14	25
Absent	01	10
Serum creatinine		
High	14	23
Normal	01	12

Table 1: Correlation between RI and Hypertension, Serum Creatinine

	RI		Sensitivity	Specificity	PPV	NPV	Accuracy
	Positive	Negative					
Glomerular disease							
Present	04	33	10.8%	15.4%	26.7%	5.7%	12%
Absent	11	02					
Tubulointerstitial disease							
Present	11	02	84.6%	89.2%	73.3%	94.3%	88%
Absent	04	33					

Table 2: Test of Significance for RI and Glomerular Disease and Tubulointerstitial Diseases

The Z-Test to test proportions from two independent groups showed that there was statistically significant difference between the two groups.

	RI	
Cortical echo	Positive	Positive
Raised	13	21
Not raised	2	14

Table 3: Correlation between RI and Cortical Echo

DISCUSSION: Duplex Doppler sonography seems to be a very useful method in the evaluation of diverse renal pathological conditions both in native and transplanted kidneys including renal arterial stenosis, kidney obstruction and acute transplant rejection. Some intrinsic renal diseases produce marked alterations in the RI while other renal diseases are characterised by normal RI values. In an attempt to identify specific pathologic features that do or do not affect the RI, four studies compared RI values with kidney biopsy results. In a study of Platt et al. carried out on 41 patients, kidneys with active disease in the tubulointerstitial part and/or vasculitis were found to have

elevated mean RI values, while kidneys with disease limited essentially to glomerulus normal RIs.⁵ Mostbeck et al, published a study correlating renal biopsy findings with RI's in 34 patients.⁶ They performed a more detailed study of histopathologic changes affecting RI than had previously been reported. They found that RI correlated with vascular intrarenal disease, glomerular sclerosis, interstitial oedema and focal interstitial fibrosis. In agreement with the other biopsy series, Mostbeck et al found normal RI values in 67% of patients with GN.⁶ These results are in accordance with those of Platt et al, who found normal values in the kidneys with disease limited to the glomeruli and elevated RIs with tubulointerstitial affection.⁷ In a study, Galesic et al used β_2 -microglobulin as a marker of tubulointerstitial affection and found statistically significant correlation between value of β_2 -microglobulin, and RI.⁸ Prabakar et al concluded that resistive and atrophic indices can be used to predict the presence of tubulointerstitial lesion in glomerular disease with high sensitivity and specificity. RI fared better than AI to predict the presence of tubulointerstitial disease.⁹

In our study, all patients with different types of glomerulonephritis had elevated RI in comparison with healthy control subjects. Renal vascular resistance was greater than 0.60, which was almost the same as the values of RI of patients with glomerulonephritis described in the study of Platt et al.⁷ The mean RI in our patients was elevated in comparison with healthy Indian subjects which was less than 1.6 as described in the study of Prabahar et al⁹ and possible explanation is the presence of histopathological signs of chronicity in the kidney tissue. In our prospective study, we have found renal Doppler analysis with RI measurements to be promising in differentiating major types of renal medical disease.

CONCLUSION: In conclusion, duplex Doppler sonography would seem to detect a state of increased vascular resistance (elevated RI) in some forms of renal parenchymal disease but not in others. Our data suggest that certain forms of renal parenchymal disease such as interstitial nephritis and acute tubular necrosis in which the traditional sonogram is generally unremarkable of (except for the changes in echogenicity and size of the kidneys) should generally be expected to have increased vascular resistance (RI) detected by Doppler study.

REFERENCES

1. Preston RA, Epstein M. Renal parenchymal disease and hypertension. *Semin Nephrol* 1995;15(2):138-151.
2. Thurston W, Wilson SR. The urinary tract. In: Rumack CM, Wilson SR, Charboneau JW, ed. *Diagnostic Ultrasound*. Philadelphia: Mosby 2005:321-393.
3. Allan PL, Dubbins PA, Pozniak MA, et al. *Clinical Doppler ultrasound*. 2nd edn. Churchill Livingstone: Elsevier 2006.
4. Parolini C, Noce A, Staffolani E, et al. Renal resistive index and long-term outcome in chronic nephropathies. *Radiology* 2009;252(3):888-896.
5. Platt JF, Ellis JH, Rubin JM, et al. Intrarenal arterial Doppler sonography in patients with nonobstructive renal disease: correlation of resistive index with biopsy findings. *AJR* 1990;154(6):1223-1227.
6. Mostbeck GH, Kain R, Mallek R, et al. Duplex Doppler sonography in renal parenchymal disease. *J Ultrasound Med* 1991;10(4):189-194.
7. Platt JF. Duplex Doppler evaluation of native kidney dysfunction: obstructive and nonobstructive disease. *AJR* 1992;58(5):1035-1042.
8. Galesic K, Sabljari-Matovinovic M, Tomic M, et al. Renal vascular resistance in glomerular diseases- correlation of resistance index with biopsy findings. *Coll Antropol* 2004;28(2):667-674.
9. Prabahar MR, Udayakumar R, Rose J, et al. Prediction of tubulointerstitial injury by Doppler ultrasound in glomerular diseases: value of resistive and atrophic indices. *J Assoc Physicians India* 2008;56:21-26.