



Efficacy of Renal Doppler in Intrinsic Renal Parenchymal Diseases: A Retrospective Study in a Tertiary Hospital

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ABSTRACT

Aims & objectives

1. To determine the mean resistive index of intrarenal segmental arteries using color Doppler in renal parenchymal disease.
2. Retrospective assessment of sensitivity of RI to distinguish medical renal disease.

Summary: In the present study during the period of 12 months, 50 patients of medical renal disease who underwent renal biopsy were evaluated with renal doppler using RI factor as criteria. Patients with glomerular disease had normal RI values and increased RI value were seen in case of tubulointerstitial, vascular pathologies. Thus RI helps in localizing the disease pathology and is also helpful in assessing the prognosis of the disease once it is diagnosed.

Doppler could not differentiate between tubulointerstitial and vascular diseases and biopsy remains the gold standard to differentiate them.

Conclusion: The Doppler findings of our study were correlated with renal biopsy and found that intrarenal segmental arterial RI can clearly differentiate among glomerular and non glomerular pathologies.

Key words: Renal Doppler, resistive index, glomerular diseases, tubulo interstitial diseases, vasculitis, renal biopsy.

Introduction

Ultrasound was used as initial modality to evaluate renal parenchymal pathology in patients who present with hematuria, proteinuria, ascitis and renal failure after clinical and laboratory evaluation.

Ultrasound provides information regarding size, echogenicity, cortical thickness, corticomedullary differentiation, helps in assessing disease chronicity but these will not help in differential diagnosis or management of renal disease.^(1,2)

Doppler as an adjunct to grey scale imaging improves the noninvasive assessment of medical renal disease^(3,4,5). RI is the most important renal parameter in various types of medical renal diseases and correlates with histopathological findings and thus RI analysis provides renal functional evaluation.

Increased cortical echogenicity is an insensitive indicator of renal parenchymal diseases.^(6,7)

The RI of intrarenal vessels in normal adult kidney has been reported to range from 0.58 to

0.64 and RI of 0.7 is considered as upper limits of normal in adults.^(8,9) In children and neonates RI of 0.7 to 1.0 is normal. RI in children decreases with age and after 4 to 5 years it stabilizes to adult range^(10,11).

Thus Duplex Doppler sonography helps in evaluation of renal functional status in medical renal disorders⁽¹²⁾.

Materials and Methods

The present study comprising of 50 cases aged above 10 years referred from nephrology department, Gandhi hospital who underwent renal biopsy with symptoms of medical renal diseases were retrospectively correlated with renal Doppler using intra renal segmental arterial RI values by Esoate, My lab machine for a period 1 year from January 2016 to December 2017, in the Department of Radiodiagnosis in Gandhi hospital.

Initially patients were evaluated using grey scale ultrasound to evaluate renal size, shape, cortical thickness, echotexture, cortico medullary differentiation and pelvicalyceal system.

Patients with dilated pelvicalyceal system were eliminated from our study.

Normal renal echogenicity

The cortical echogenicity of the kidney has been analyzed by comparing the image echo strength of the renal cortex with that of the adjacent liver and the cortical echogenicity has been classified into 4 groups^(13,14).

Grade-O: Normal echogenicity of the cortex of the right kidney was less than that of the liver.

Grade-I: Echogenicity of the cortex of the right kidney equal to that of the liver.

Grade-II: Echogenicity of the right kidney was greater than that of the liver but less than that of the renal sinus.

Grade-III: Echogenicity of the renal cortex was equal to that of the renal sinus.

Observations & Results

Table- 1 Clinical Presentation

Clinical presentation	Number of patients	Percentage
Ascites	32	64%
Hematuria	30	60%
Proteinuria	23	46%
Oliguria	16	32%
Anasarca	13	26%
Others	20	40%

Table-2 Grading of renal parenchymal echogenicity using ultrasound

	Number of patients	percentage
Normal renal echogenicity	10	20
Grade-I renal parenchymal changes	17	34
Grade-II renal parenchymal changes	17	34
Grade-III renal parenchymal changes	6	12

Table-3 Relation between renal parenchymal echogenicity and serum creatinine

Renal parenchyma echogenicity	No. of Patients as per creatinine level (mg / dl)			
	Normal < 1.4	1.4 - 1.9	2-3.9	>4
Normal renal echogenicity	8	2	0	0
Grade-I renal parenchymal changes	0	12	5	0
Grade-II renal parenchymal changes	0	8	9	0
Grade-III renal parenchymal changes	0	0	0	6
Total number of patients	8	22	14	6

Table-4 Relation of serum creatinine to resistive index

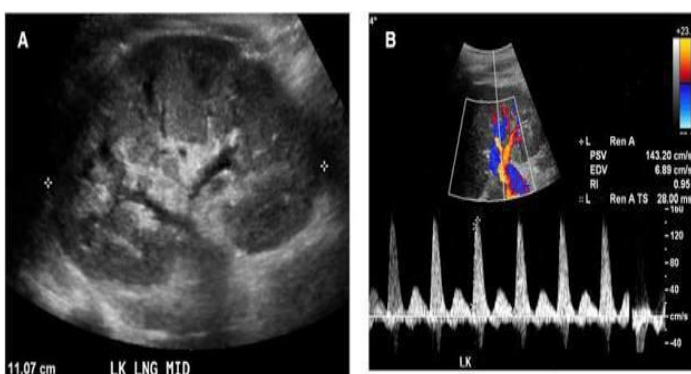
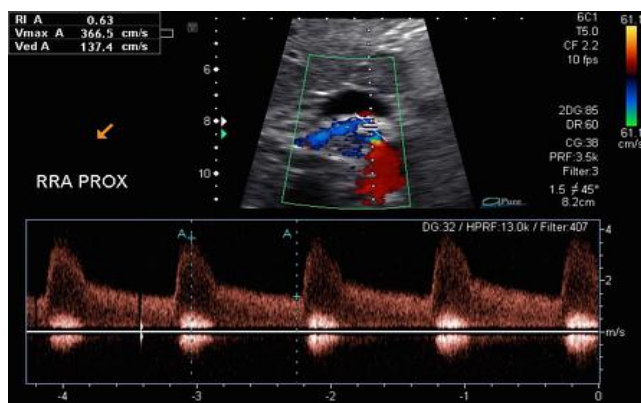
Mean RI	No. of patients as per creatinine level (mg / dl)			
	Normal < 1.4	1.4 - 1.9	2-3.9	>4
≤ 0.49	0	0	0	0
0.5 – 0.6	0	2	0	0
0.61-0.7	3	4	2	1
0.71-0.8	4	14	8	2
≥ 0.8	1	2	4	3
Total no. of patients	8	22	14	6

Table-5 HPE findings on renal biopsy

Tubulo interstitial	23
Vascular	07
Glomerular	20

Relation between RI and biopsy finding

Out of 23 patients of tubulo interstitial 18 patients have elevated RI.(78.2%) Out of 7 patients of vascular all patients have elevated RI (100%). Out of 20 patients of glomerular pathology 20 patients have normal RI (100%).

**Discussion**

It is a retrospective study in a sample volume of 50 patients, above the age group of 10 years, referred from nephrology department inpatients, with non obstructive medical renal parenchymal disease after undergoing biopsy to correlate with intrarenal Doppler RI values.

B Mode is used to assess the morphological status of the kidney and the qualitative and quantitative information is provided by renal Doppler by measuring RI, which is the ratio of PSV-EDV/PSV. This is done at three different areas of kidney in interlobar or arcuate arteries.

A series of studies have been done to correlate RI of intra renal arteries with renal biopsy findings (8,15,16,17).

Medical renal diseases includes glomerular sclerosis, glomerulo nephritis, tubulo interstitial and vasculopathy according to renal biopsy findings.

Medical renal diseases can be due to drugs, infections, diabetes, metabolic, hematological diseases (multiple myelomas, leukaemias), amyloidosis, SLE, Allograft rejection. These effect the three functional compartments of the kidney ie., vasculature, glomerulus and tubule interstitium. All these are collectively responsible for delivery of blood , plasma filtration and modification of glomerular filtration rate. All patients with chronic renal disease show decline in renal function irrespective of etiology and leads to end stage renal failure which require renal dialysis or transplantation. Histologically end stage renal disease presents as glomerular sclerosis ,vascular sclerosis and tubule interstitial fibrosis.

Common symptoms include Anasarca, muscle cramps ,skin disorders ,hematuria ,nausea vomiting ,poor appetite and fatigue. Common complications include anaemia, hypertension, hypoproteinemia and renal osteo dystrophy.

Doppler is done in these patients using RI values as the criteria and values above 0.7 or more were considered abnormal ⁽¹⁸⁾.

Intrinsic renal disease will increase RI even with normal creatinine values.

Ascites was the commonest clinical presenting complaint in our study group and this was compared with previous study by Ikee R Nihon & Jinzo Gakkai Shi. ^(16,17).

Patients showed increased creatinine levels and increased renal echotexture due to underlying renal pathology as compared to studies by Ikee R Nihon & Jinzo Gakkai Shi. ^(16,17).

Our study group started from the age of 10 years and above. Studies by Bude and colleagues ⁽¹⁹⁾ showed that RI is age dependent and it is commonly above 0.7 in children less than 4 years which is the upper limit of normal in adults.

RI values taken at different locations are averaged to get mean RI as the study by Korean and Associates⁽⁹⁾ which show that if only single RI is taken the status of kidney might be misinterpreted. All 20 patients with glomerular diseases had normal RI in our study as compared to the study done by Ikee and colleagues⁽¹⁶⁾.

RI values were increased in patients with tubulo interstitial and vascular pathology related disorders⁽²⁰⁾.

Renal vasculitides and tubulointerstitial nephropathies are more frequently identified by USG and Doppler than glomerular diseases as glomerular component is only 8% of renal parenchymal disease⁽²¹⁾.

Renal Doppler is not of much help in renal transplant as RI values are increased in rejection infection renal vein thrombosis and also by extrinsic compression and due to drugs. Hence not of much help in cases of renal transplant⁽²⁴⁾. However we did not encounter any case of renal transplant in our study.

Conclusion

Usg shows decreased renal size, thinning of renal parenchyma, increased echogenicity and also cysts to characterize the chronicity of the disease and the exception of diabetic nephropathy where in the renal size and parenchymal thickness are maintained till end stage renal failure. The same applies in amyloidosis. Hence renal Doppler of intrarenal segmental arteries shows information about microvascular and parenchymal changes which help for therapeutic intervention^(22,23).

RI values can differentiate between glomerular and non glomerular pathologies but cannot differentiate tubulo interstitial and vascular pathologies. Thus biopsy remains the gold standard as RI cannot differentiate histopathological diseases which include both tubulo interstitial and vasculitis to an equal extent and this is in agreement with studies done by Tublin and associates⁽⁸⁾.

However RI can be used in follow up of renal parenchyma diseases to predict improvement or worsening of renal function.

Summary

It is a retrospective study, on 50 patients with medical renal disease who underwent biopsy, using intra renal Doppler RI values to correlate with renal biopsy findings. Patients with glomerular pathology were found to have normal RI values and those with tubulo interstitial and vascular diseases were found to have more RI values above 0.7. Thus RI helps in localizing the disease pathology. RI is also helpful in assessing the prognosis of the disease once it is diagnosed. However Doppler could not differentiate between tubulo interstitial and vascular diseases and biopsy remains the gold standard to differentiate them.

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