ORIGINAL RESEARCH PAPER

Volume-7 | Issue-11 | November-2018 | PRINT ISSN No 2277 - 8179

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

# CORRELATION BETWEEN SONOGRAPHIC AND HISTOPATHOLOGICAL FINDINGS IN PATIENTS UNDERGOING NATIVE RENAL BIOPSY

**Radiodiagnosis**

**Bipin Augustine Joseph*** Resident, Dept. of Radiodiagnosis, Father Muller Medical College Hospital, Mangalore-575002 *Corresponding Author

**H.B.Suresh** Professor and H.O.D, Dept. of Radiodiagnosis,Father Muller Medical College Hospital, 575002

**Manjunath J. Kulkarni** Professor and H.O.D,Dept. of Nephrology, Father Muller Medical College Hospital, 575002.

**Mohd. Kaleemullah** Resident, Dept. of Radiodiagnosis, Father Muller Medical College Hospital, Mangalore-575002

## ABSTRACT

**Introduction:** Diseases affecting kidneys can be accurately identified by renal biopsy, but diagnostic sonography plays a role in initial diagnosis and patient selection. This study is an attempt to look into sonographic findings in medical renal disease and its correlation with histopathological findings in patients undergoing renal biopsy.

**Materials and methods:** A retrospective study was conducted on 102 patients who underwent native renal biopsy and, diagnostic renal sonography within 48 hours.

**Results:** 102 patients underwent ultrasound guided renal biopsy of whom 52% were males and 48% females. The mean age was 44 years with a range of 18-72 years. Of all the patients who underwent renal biopsy, 24.5% had normal appearing kidneys on sonography. Near half of the patients has Grade 1 increase in cortical echogenicity and cortico-medullary differentiation (CMD) was maintained in two third of the patients. Acute tubular necrosis was associated with bulky kidneys. Renal cortical echogenicity had highly significant correlation with loss of CMD, glomerular pathologies, interstitial fibrosis , tubular atrophy and significant correlation with arteriosclerosis. Loss of CMD had highly significant correlation with glomerular disease, tubular disease, interstitial fibrosis, tubular atrophy and significant correlation with interstitial inflammation and arteriosclerosis.

**Conclusions:** Renal biopsy is an indispensable tool to diagnose the pathology behind renal dysfunction. In medical renal disease, renal sonography may be normal or non-specific about etiology, but it definitely plays a role as a good screening tool.

## KEYWORDS

Renal cortical echogenicity, Cortico-medullary differentiation(CMD), Native renal biopsy, Sonography

## INTRODUCTION

The human kidney is a structurally complex organ with multitude of functions. The diseases affecting kidneys can be broadly classified into primary or secondary (to systemic disease), and further pathologically into those affecting the glomeruli, tubules, interstitium and the blood vessels. Due to anatomic interdependence, most them affect multiple compartments. The kidney has a good functional reserve before the patient deteriorates. Early recognition and treatment of renal dysfunction may prevent the patient from slipping into chronic irreversible renal damage.[1]

The diagnostic gold standard is histopathological examination of tissue obtained by ultrasound guided renal biopsy. But all patients are not subjected to renal biopsy. It is indicated when the patient is expected to have a reversible renal injury, which is amenable to treatment, and the diagnosis could not be obtained with adequate confidence by clinical features and laboratory parameters alone.[2] Renal sonography is advised mainly to look into the renal size, parenchymal thickness, cortical echogenicity, cortico-medullary differentiation and, to rule out obstructive uropathy and renal neoplasms.[1]

Studies on correlation between renal cortical echogenicity and histopathological findings show that interstitial inflammation, cortical scarring and tubular atrophy had good correlation with cortical echogenicity while glomerular diseases did not.[3,4] However, few other studies show that even glomerular diseases can show increased cortical echogenicity, though less than that of tubulointerstitial diseases.[4] This study is an attempt to look into factors affecting renal size, cortical echogenicity and corticomedullary differentiation.

## MATERIALS AND METHODS

A retrospective study was conducted in Father Muller Medical College Hospital, Mangalore after the ethics committee approval. 102 adult patients who underwent ultrasound guided native renal biopsy from January 2015 to December 2017 were included in the study.

### INCLUSION CRITERIA:

1. All patients who underwent native kidney biopsy during the study period.
2. Patients in whom renal sonography was performed within 48 hours prior to the biopsy.
3. Age above 18 years

### EXCLUSION CRITERIA:

1. Patients with established chronic kidney disease.
2. Patients in whom any of the above mentioned data was not available.
3. Renal biopsy of transplant kidney or mass lesion

**Grading of renal cortical echogenicity[5]:** (Figure 1)
Grade 0: Normal/ cortical echogenicity less than liver
Grade 1: same as liver
Grade 2: more than liver but less than renal sinus
Grade 3: equal to the renal sinus.

**Grading of Renal Cortico-medullary differentiation (CMD)[6]:** (Figure1)
Grade 0: CMD maintained
Grade 1: CMD blurred
Grade 2: CMD lost

Diagnostic renal sonography was done on Philips iU22, Philips Affiniti 50G, Philips HD7, Toshiba Xario 15D and Siemens X300. Renal biopsy was performed on Siemens X300.

## STATSICAL ANALYSIS

Percentages of various parameters were calculated. Correlation between renal sonographic findings and histopathology were analyzed using Chi-square test and Fishers exact test.

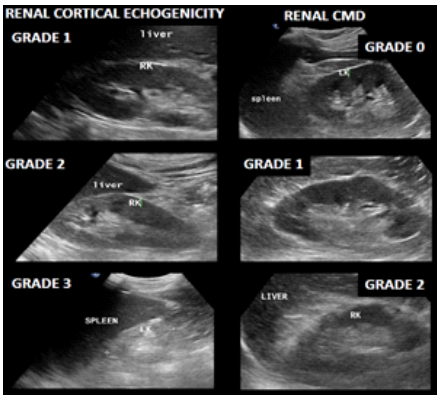


**Figure 1: Grading of renal cortical echogenicity and Corticomedullary differenatiation (CMD)**

## RESULTS

102 patients underwent ultrasound guided renal biopsy to look into the underlying pathology. 52% were males and 48% females.

**Age distribution:**
- Below 20yrs - 4.9%,
- 21-30yrs - 17.6%,
- 31-40yrs - 19.6%,
- 41-50yrs - 21.6%,
- 51-60yrs - 21.6%,
- 61-70yrs - 11.8%
- Above 70yrs - 2.9%.

The mean age was 44 years with a range of 18-72 years.

**Renal size:**
Renal biopsy was performed only if the renal size was above 9cm. The renal size distribution:
- 9-10cm - 31.4%
- 10-11cm - 46.1%
- 11-12cm - 12.7%
- >12cm - 9.8%

**Renal sonography**
- Normal 24.5%
- Abnormal 75.5%

**Renal cortical echogenicity:**
- Normal - in 26.5% patients
- Grade 1 - 48%
- Grade 2 - 17.6%
- Grade 3 - 7.8%

**Cortico-medullary differentiation:**
- Maintained in 68.6%
- Blurred in 12.7%
- Lost in 18.6%

**Broad classification on histopathology:**
- Glomerular pathology only in 62.7%
- Tubular pathology only in 4.9%
- Both in 32.4%

**Pathological diagnosis**
- Minimal change disease 19.6%
- Focal segmental glomerulosclerosis 10.8%
- Membranous nephropathy 12.7%
- Membranoproliferative glomerulonephritis 2.9%
- Immune complex mediated disease 7.8%
- Complement C3 mediated glomerulo-nephritis 6.8%
- IgA nephropathy 6.8%
- Diabetic nephropathy 11.7%
- Lupus nephritis 7.8%
- Pauci immune glomerulonephritis 1.9%
- Acute tubular injury 22.8%
- Interstitial nephritis 10.7%
- Infection related 2.9%
- Others 3.9%

Note that the same patient may have more than one compartment involvement.

**Percentage of sclerosed glomeruli:**
- Nil – 87.3% cases
- <25% - 5.9%
- >25% - 6.9%

**Degree of Interstitial Fibrosis and Tubular atrophy**
- Absent - in 65.7% cases
- Mild (<25%) - 23.5%
- Moderate (25-50%) - 6.9%
- Severe (>50%) - 3.9%

**Presence of interstitial inflammation:**
- Absent – 83.3%
- Present – 16.7% cases

**Degree of Acute tubular injury**
- Absent – 77.2% cases
- Mild – 14.9%
- Moderate – 5.9%
- Severe – 2%

**Arteriosclerosis**
- Absent – 80.4%
- Present – 19.6% cases

**TABLE – 1 CORRELATION SONOGRAPHY AND HISTOPATHOLOGY (p values)**

| PARAMETERS ANALYZED | RENAL SIZE | CORTICAL ECHOGENICITY | CMD |
|---|---|---|---|
| AGE | 0.909 | 0.608 | 0.116 |
| GENDER | 0.690 | 0.703 | 0.341 |
| CORTICAL ECHOGENICITY | 0.608 | - | - |
| CMD | 0.180 | 0.000 | - |
| GLOMERULAR DISEASE ONLY | 0.840 | 0.003 | 0.000 |
| TUBULAR DISEASE ONLY | 0.438 | 0.401 | 0.004 |
| BOTH | 0.545 | 0.004 | 0.000 |
| %SCLEROSED GLOMERULI | 0.502 | 0.069 | 0.114 |
| FIBROSIS AND ATROPHY | 0.523 | 0.007 | 0.000 |
| INTERSTIAL INFLAMMATION | 0.310 | 0.376 | 0.028 |
| ACUTE TUBULAR INJURY | 0.002 | 0.065 | 0.090 |
| ARTERIOSCLEROSIS | 0.715 | 0.036 | 0.036 |

## DISCUSSION:

Renal sonography is a routine diagnostic tool in day to practice while renal biopsy is performed when clinical, lab and sonography is unable to pinpoint the cause of deterioration in renal function. This study was an attempt to look into patients who underwent native renal biopsy for the same and to correlate sonographic and histopathologic findings.

Our study showed mild male preponderance. Only patients above 18 years were included and the mean age was 44 years with the most common age group being the 5th and 6th decades.

The mean renal size was 10.6cm and the kidneys were bulky (>12cm) in 9.8% cases. Only patients with renal size greater than 9cm underwent renal biopsy. Moghazi et al4 found that renal size decreased with cortical scaring and tubular atrophy. However, in our study, Fishers exact test was used to look into correlation between renal size and various histopathological parameters (Table 1) and it was found that the renal size has significant correlation only with acute tubular injury (p=0.002). In other words, patients with acute tubular injury had bulky kidneys.

An important point to be noted is that, of all the patients who

underwent renal biopsy, 24.5% patients had normal appearing kidneys on sonography. This indicates that normal sonography doesn't mean normal renal function. Renal cortical echogenicity was equal to liver (Grade 1) in 48% cases, more than liver in 17.6% and equal to renal sinus in 7.8%. The cortico-medullary differentiation was maintained in majority (68.6%), blurred in 12.7% and lost in 18.6%.

Histopathological examination showed that 68.6% cases had only glomerular pathology, 4.9% only tubular and rest 32.4% had disease affecting both the compartments. 22.8% patients had acute tubular injury and 19.6% Minimal change disease. 12.7% patients had membranous nephropathy and 10.8% had focal segmental glomerulosclerosis (FSGS). Interstitial nephritis was found in 10.7% cases. There was one case of Henoch Scholein purpura (HSP) in an 18yr old girl, though it is a childhood disease.

In studies done by Rosenfield and Siegel[3] and Moghazi et al[4], it was found that cortical echogenicity increased with interstitial inflammation and cortical scaring. Paivansalo et al[7] showed that tubulointerstitial diseases have more echogenic cortex than glomerular diseases. Hricak et al[5] found statistically significant positive correlation between cortical echogenicity and focal tubular atrophy and degree of cortical scarring.

In our study, renal cortical echogenicity had highly significant correlation with loss of CMD, glomerular disease, interstitial fibrosis and tubular atrophy and significant correlation with arteriosclerosis. (Table 1). This was in agreement with study by J.H. Lee[8] where, cortical echogenicity had good correlation with interstitial inflammation/ fibrosis and tubular atrophy.

In our study, loss of CMD had highly significant correlation with glomerular disease, tubular disease, interstitial fibrosis and tubular atrophy and significant correlation with interstitial inflammation and arteriosclerosis. (Table 1) Other studies have shown that CMD gets blurred in chronic interstitial nephritis.[1]

In our study, interstitial inflammation had significant correlation only with loss of CMD, but not with cortical echogenicity. No significant correlation was seen between degree of glomerular sclerosis with cortical echogenicity or CMD.

Moreover, renal size, cortical echogenicity and CMD did not show any significant change with age or gender.

## CONCLUSIONS:

Renal biopsy is an indispensable tool to arrive at the pathological diagnosis behind renal dysfunction. Acute tubular injury was associated with bulky kidneys. Renal cortical echogenicity had highly significant correlation with loss of CMD, glomerular pathologies, interstitial fibrosis, tubular atrophy and significant correlation with arteriosclerosis. Loss of CMD had highly significant correlation with glomerular disease, tubular disease, interstitial fibrosis, tubular atrophy and significant correlation with interstitial inflammation and arteriosclerosis. Interstitial inflammation had significant correlation only with loss of CMD, but not with cortical echogenicity. No significant correlation was seen between degree of glomerular sclerosis and cortical echogenicity or CMD. Thus, in medical renal disease, renal sonography may be normal or non-specific regarding etiology, but it definitely plays a role as a good screening tool.

## REFERENCES:


1. O'Neill, W. C. (2000). Sonographic evaluation of renal failure. American Journal of Kidney Diseases, 35(6), 1021–1038. https://doi.org/10.1016/S0272-6386(00)70036-9
2. Haas, M., Rastaldi, M. P., & Fervenza, F. C. (2014). Histologic classification of glomerular diseases: Clinicopathologic correlations, limitations exposed by validation studies, and suggestions for modification. Kidney International, 85(4), 779–793. https://doi.org/10.1038/ki.2013.375
3. Rosenfield, A. T., & Norman J. Siegel. (1981). Renal Parenchimal disease: histopathologic- sonographic correlation. AJR, 137(137:), 793–798.
4. Moghazi, S., Jones, E., Schroepple, J., Arya, K., McClellan, W., Hennigar, R. A., & O'Neill, W. C. (2005). Correlation of renal histopathology with sonographic findings. Kidney International, 67(4), 1515–1520. https://doi.org/10.1111/j.1523-1755.2005.00230.x
5. Hricak, H., Cruz, C., Romanski, R., Uniewski, M. H., Levin, N. W., Madrazo, B. L., … Eyler, W. R. (1982). Renal parenchymal disease: sonographic-histologic correlation. Radiology, 144(1), 141–7. https://doi.org/10.1148/radiology.144.1.7089245
6. Gareeballah, A., Gameraddin, M., Mustafa, H., & Alshabi, S. (2015). Sonographic Findings in Renal Parenchymal Diseases at Sudanese. Open Journal of Radiology, 5(December), 243–249.
7. Singh, A., Gupta, K., Chander, R., & Vira, M. (2016). Sonographic Grading of Renal Cortical Echogenicity and Raised Serum Creatinine in Patients With Chronic Kidney Disease. Journal of Evolution of Medical and Dental Sciences, 5(38), 2279–2286. https://doi.org/10.14260/jemds/2016/530
8. Lee, J. H., Cho, M. H., Chung, S. I., & Kim, K. S. (2017). Relationship of Renal Echogenicity with Renal Pathology and Function, 0242, 47–52.