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 IPGMR, 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.
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 $RI = \frac{\text{Peak systolic frequency shift} - \text{minimum diastolic frequency shift}}{\text{Peak systolic frequency shift}}$. 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%).

<table>
<thead>
<tr>
<th>Hypertension</th>
<th>RI</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>PPV</th>
<th>NPV</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present</td>
<td>14</td>
<td>10.8%</td>
<td>15.4%</td>
<td>26.7%</td>
<td>5.7%</td>
<td>12%</td>
</tr>
<tr>
<td>Absent</td>
<td>01</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serum Creatinine</td>
<td>High</td>
<td>14</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>01</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

**Table 1: Correlation between RI and Hypertension, Serum Creatinine**

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

<table>
<thead>
<tr>
<th>Cortical Echo</th>
<th>RI</th>
<th>Positive</th>
<th>Negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raised</td>
<td>13</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>Not raised</td>
<td>2</td>
<td>14</td>
<td></td>
</tr>
</tbody>
</table>

**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. Mostbeck et al, published a study correlating renal biopsy findings with RI's in 34 patients. 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. 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. In a study, Galesic et al used ß2-microglobulin as a marker of tubulointerstitial affection and found statistically significant correlation between value of ß2-microglobulin, and RI. Prabahar 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.
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. 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 al 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