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# Utility of Renal Resistive Index in detection of renal dysfunction in cirrhosis of liver

Gastroenterology

**KEYWORDS:** Renal Resistive index (RI), cirrhosis, renal dysfunction.

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## ABSTRACT

**Aim:** To determine the utility of noninvasive assessment of Renal resistive index (RI) in different stages of cirrhosis
and its clinical utility in early detection of renal dysfunction in cirrhosis.

**METHODS:** A prospective cohort analysis of patients with cirrhosis having normal serum creatinine was performed. Measurement of baseline characteristics and renal resistive index was recorded and compared as per the stages of liver disease according to child Pugh score. Renal resistive index >0.7 was considered abnormal. Patients were followed up for 12 months for development of renal dysfunction and the utility of renal resistive index was determined.

**RESULTS:** Ninety-eight patients of cirrhosis constituted the study population. Renal resistive index was deranged in 25/98 patients inspite of normal serum creatinine.Renal resistive index was significantly different across the different stages of liver (CTP A, B and C class). On follow-up for 12 months, forty-one(41.8%) patients developed renal dysfunction. Renal Resistive index showed a sensitivity and specificity of 70% and 68.9% respectively in predicting the renal dysfunction.

**CONCLUSION:** Renal Resistive index is an important non invasive marker of renal dysfunction in cirrhosis.

**Introduction:**

Renal dysfunction often develops in patients with livercirrhosis and is an important prognostic factor in cirrhosis. The impairment of kidney function is causedby severe renal arterial vasoconstriction due to complex changes in systemic hemodynamic (1,2) Renal arterial vasoconstriction may persist for weeks, even months before an increase of blood urea nitrogen or serum creatinine values can be discovered (3). Renal resistive index (RI) increases with progressive liver disease and predicts renal dysfunction in cirrhosis.Renal resistive index has been evaluated in detection of hepatorenal syndrome. It is described in the existing literature on patients with cirrhosis that they show increased intrarenal RI values (3-5).Hence we carried out this study toinvestigate the value of RI measurement in detection of renal function impairment in patients with different stages of chronic liver disease and the clinical utility of RI to detect renal dysfunction in cirrhosis on followup.

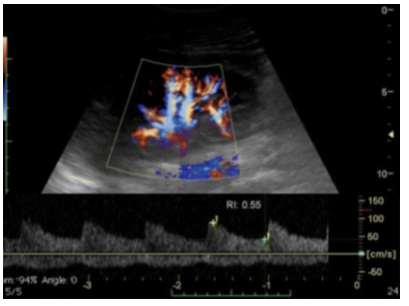
**Materials & Methods**

All treatment naïve patients with cirrhosis were prospectively included in the study from April 2010 to April 2011. All patients with raised serum creatinine and intrinsic renal disease at presentation were excluded. Baseline characteristics including clinical features, etiology of cirrhosis, complete liver function test, complete blood count ,prothrombin time was recorded and the Child-Pugh score were obtained of all patients. Ultrasonography was done in all the patients with colour Doppler and renal resistive index(RI) was calculated by radiologist.

RI = (peak systolic velocity - end diastolic velocity ) / peak systolic velocity.

Three measurements were done to get a representative value.(6). The normal value of RI is 0.60-0.70 and is measured at the arcuate arteries (corticomedullary junction) or interlobararteries (adjacent to medullary pyramids).Renal resistive index of 0.7 is considered abnormal and was compared for development of renal dysfunction on follow up.

**Figure No.1: Renal Resistive Index**




**Statistics**

Baseline characteristics were studied using descriptive statistics. Results were expressed as means ± standard deviation or with Interquartile range(IQR) where applicable. Dichotomous and categorical variables were compared using Chi square test. Continuous variables were compared using Kruskal and Wallis non parametric tests. All the statistical analysis was done using SPSS 16.

**Results**

Out of 129 patients, 98 patients were included (82 males).Mean age (years) of all patients was 51.0+/-7.5. Mean MELD score was 13.2+/-4.4. Patients were divided according to the severity of liver disease as per the Child Pugh Turcotte score into the following CTP Class A-23(23.5%), CTP Class B- 49(50%) and CTP Class C- 26(26.5%) patients respectively. Cause of cirrhosis in patients was alcohol 69(71%), viral 13(13%) and cryptogenic 12(12%), Autoimmune-2 and Wilsons and Budd Chiari 1 each.

Baseline characteristics of 98 enrolled patients with cirrhosis are presented in Table No. 1 and 2

**Table No.1: Baseline Characteristics of enrolled patients with cirrhosis as per the CTP class.**

| Parameter | Group A (n=23) | | Group B (n=49) | | Group C (n=26) | | P value # |
|---|---|---|---|---|---|---|---|
| | Median | IQR | Median | IQR | Median | IQR | |
| HB. | 10.60 | 2.90 | 9.70 | 1.85 | 9.50 | 2.10 | 0.6976 |
| WBC | 5,600.00 | 3,000.00 | 6,600.00 | 2,650.00 | 6,700.00 | 5,250.00 | 0.0494 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| PLATELET | 86,000.00 | 50,000.00 | 100,000.0 | 42,200.00 | 83,500.00 | 74,400.00 | 0.1065 |
| PT | 11.70 | 2.30 | 14.30 | 3.20 | 15.65 | 5.28 | 0.0001 |
| INR | 1.08 | 0.21 | 1.31 | 0.30 | 1.47 | 0.48 | 0.0001 |
| T.BIL | 1.10 | 1.15 | 2.80 | 1.70 | 4.70 | 2.05 | 0.0001 |
| T.PROT | 7.10 | 0.74 | 7.00 | 1.33 | 6.90 | 1.04 | 0.4611 |
| ALBUMIN | 3.70 | 1.20 | 2.90 | 0.50 | 2.52 | 0.35 | 0.0001 |
| ALK PO4 | 68.00 | 21.00 | 89.00 | 38.00 | 78.00 | 44.00 | 0.0039 |
| GGT | 35.00 | 100.00 | 68.50 | 71.00 | 45.00 | 59.50 | 0.3457 |
| BUN | 12.00 | 6.00 | 10.00 | 4.40 | 9.50 | 5.00 | 0.1913 |
| RI | 0.60 | 0.05 | 0.65 | 0.06 | 0.71 | 0.07 | 0.0001 |
| | | | | | | | |

The values of bilirubin, albumin and INR were significantly different because they are used for the classification of the CTP score. Renal resistive index was lower in well compensated cirrhosis (CTP A ) in comparison to decompensated cirrhosis (CTP B and CTP C) . Renal resistive index worsened with the severity of liver disease. RI (>0.70) was abnormal in 25 patients(25.5%) at baseline. On regular follow up for 6 months 38 patients developed deranged creatinine (>1.5) on follow up. Renal dysfunction was seen in 15/25(60%) patients with abnormal RI and 23/73(31.5%) patients with normal RI at baseline respectively (P = 0.0120, 95%CI 4.0556 to 50.0387). Sensitivity and specificity of RI for detecting renal dysfunction was 60% and 64.5% respectively. Negative predictive value of 83.33%

**Discussion**

Renal Resistive index is a safe noninvasive assessment for detecting renal dysfunction in cirrhosis. Doppler ultrasound measurement of the RI is a useful index to quantify renovascular resistance in cirrhotic patients before HRS develops (7). Elevated RI values are more commonly seen in patients with advanced stage of liver cirrhosis as shown in studies comparing compensated cirrhosis to decompensated cirrhosis. (5,8.9). A study conducted by Goyal et al.(10) revealed that patients with cirrhosis and ascites showed significantly increased RI (0.72 ± 0.02) when compared to cirrhosis without ascites (0.62 ± 0.06). Elevated RI >0.70 was present in 16% (8/50) patients in the group with cirrhosis alone and in 60% (30/50) patients in the group who had cirrhosis and ascites. In study by Platt etal, showed 48% (19/40) had elevated RI inspite of normal creatinine.(3).Also he showed in the study population of 76 patients with RI ≥ 0.70, 55% developed kidney dysfunction and even 26% hepatorenal syndrome, whereas only 6% (6/104) of the subjects with normal RI <0.70 developed kidney dysfunction at the end of follow up (p<0.01)(3)In comparison we had 25% (25/98) elevated RI and on follow up 60% with RI>0.7 developed renal dysfunction which was significant in comparison to patients with normal renal resistive index (pvalue0.0120).

**Conclusion:** Patients with renal vasoconstriction are at higher risk of developing manifest renal failure. Renal resistive index worsens with severity of disease and also help in predicting renal dysfunction in these patients even before the rise in creatinine. Therefore, elevated RI values may be taken into account in clinical management of these patients and pharmacological treatment could be initiated for renal vasoconstriction prior to the onset of renal failure.

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