

INTRARENAL RESISTIVE INDEX AS A PROGNOSTIC PARAMETER IN PATIENTS WITH LIVER CIRRHOSIS COMPARED WITH OTHER HEPATIC SCORING SYSTEMS

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ABSTRACT

Background: Liver cirrhosis, a chronic condition was characterised by scarring and abnormal nodules formation, progressively disrupt the liver function. Subsequently, hepatorenal syndrome may occur in some of those patients, resulted from kidney dysfunction. The renal resistive index (RI) is a parameter, used to assess the blood flow resistance in kidneys. The study aims to find the relationship between RI and liver cirrhosis and other parameters. The objective is to study the levels of renal resistive index and to compare the values between patients with compensated and decompensated cirrhosis. To compare RI with MELD and the Child-Pugh scores. **Materials and Methods:** This hospital based prospective study done among 50 liver cirrhosis patients at Government Rajaji Hospital and Madurai Medical College, from May 2017 to September 2017. Based on the inclusion and exclusion criteria, participants were recruited after obtaining informed consent. Institutional Human Ethical Clearance was obtained. Data were collected using the semi structured questionnaire and entered in Microsoft Excel, analysed using SPSS software. Appropriate descriptive and inferential statistics were used, with p value <0.05 was considered as statistically significant. **Result:** The mean (SD) age of the patients is 38.3 years (6.4). Most of them were males (72%). About 30% had compensated disease and 70% had decompensated disease. About 60% had resistive index of ≤ 0.7 and 40% had resistive index of > 0.7 . The resistive index showed association with MELD score, Child Pugh score, form of cirrhosis and mortality (<0.001). **Conclusion:** Our study confirms that the RI, is an effective, non-invasive, economical functional test that provides useful information for the prognosis and management of cirrhotic patients. Elevated RIs may even disclose progress of the liver disease before changes in laboratory results. Therefore, the RI may help identify a subgroup of high-risk patients with a poor prognosis that require special therapeutic care.

INTRODUCTION

Liver cirrhosis, chronic condition of liver, characterised by fibrosis and conversion of normal liver tissue into abnormal nodules.^[1] The condition progress slowly over weeks to years. The condition is associated with higher rates of morbidity and mortality.

Liver cirrhosis was classified as Compensated and Decompensated liver cirrhosis.^[2] The difference between two types is based on presence on evidence for portal hypertension like ascites, jaundice, variceal bleeding and encephalopathy. The prognosis also differs between these two types.^[2]

Model for End stage Liver Disease (MELD) score was used to assess prognosis in patients with liver cirrhosis with parameters like serum bilirubin, creatinine and INR levels. Child Pugh score was used to determine the severity of liver dysfunction with parameters like ascites, hepatic encephalopathy, serum bilirubin, albumin and INR levels.^[3,4]

Hepatorenal syndrome is a clinical condition characterised by functional renal failure in patients with liver cirrhosis. The mechanism behind the syndrome is prerenal azotemia. In this condition, the renal arteries undergo vasoconstriction for a considerable period of time ranging from weeks to

months. Hence there will rise in serum creatinine levels and blood urea nitrogen levels.^[1,4,5]

In liver cirrhosis patients, there will be decline in cardiac output and systemic vascular resistance. Hence there will be worsening of renal vasoconstriction, resulting in decreased renal blood flow and renal failure.^[1]

Intrarenal resistive index is the index used for measuring the intrarenal vascular resistance using Doppler Ultrasound. Renal vasoconstriction is indicated by the higher values of resistive index. Normal values will be less than 0.7. This RI helps in early identification of renal dysfunction and helps to provide the treatment to improve the outcome in patients with liver cirrhosis.^[1,6] RI was used to assess the severity and prognosis similar to MELD and Child Pugh score.^[4]

Hence, the study aimed to assess the relationship between renal resistive index and patients with liver cirrhosis and various parameters in those patients.

Aims and Objectives

1. To study the levels of renal resistive index in patients at various stages of liver cirrhosis.
2. To compare the values between patients with compensated and decompensated cirrhosis.
3. To compare their prognostic impact with those of the Model for End-Stage Liver Disease(MELD) and the Child-Pugh scores.

MATERIALS AND METHODS

This was a hospital based prospective study done among 50 liver cirrhosis patients admitted in medical ward at Government Rajaji Hospital and Madurai Medical College, during the period from May 2017 to September 2017. Consecutive sampling method was followed. Department of Medical Gastroenterology, Department of Biochemistry and Department of Radiology were involved in the study. Patients with liver cirrhosis of any etiology, diagnosed by clinical, biochemical and imaging methods were included in the study. Subgroup of patients included in the study were, patients with compensated cirrhosis (absence of ascites, hepatic encephalopathy, upper gastrointestinal bleed) and patients with decompensated cirrhosis. Patients presenting with diabetes, hypertension, nephrotoxic medication intake, acute gastrointestinal bleeding and shock, ultrasonographic evidence of obstruction or parenchymal renal disease and sepsis were excluded from the study.

Institutional Human Ethical Clearance certificate was obtained. Informed consent was obtained from the participants/ caretakers to participate in the study. Data were collected using the semi structured questionnaire. Relevant information like history and clinical examination was done. Laboratory investigations like complete blood count, liver function tests, renal function tests, PT INR, serum albumin, ultrasound abdomen and renal artery duplex doppler were done. Based on the details obtained,

renal resistive index was calculated and compared with MELD/CTP score.

Data were entered in Microsoft Excel and analysed using SPSS software. Descriptive statistics like mean and standard deviation were used for continuous variables. Frequency and proportion were used for categorical variables. Inferential statistics like correlation coefficient and chi square test were used. p value <0.05 was considered as statistically significant.

RESULTS

The study was conducted among 50 liver cirrhosis patients. The results were depicted below.

[Table 1] depicts the demographic details. The mean (SD) age of the patients is 38.3 years (6.4). Most of them belong to 36 to 40 years of age. Most of them were males (72%).

[Table 2] depicts the etiology and clinical findings. Most of them had alcohol etiology (52%), followed by hepatitis B infection (26%), cryptogenic etiology (18%), autoimmune etiology (2%) and Wilson disease (2%). About 70% had ascites and 16% had hepatic encephalopathy. About 30% had compensated disease and 70% had decompensated disease. About 16% were dead.

[Table 3] depicts the laboratory findings. The mean (SD) of serum bilirubin was 3.56mg/dl (3.01). Only 14% had serum bilirubin level \leq 1mg/dl. About 28% had serum bilirubin level from 1.1 to 2.0mg/dl. All others had bilirubin level more than 2mg/dl. The mean (SD) of serum creatinine was 1.5mg/dl (1.33). About 52% had serum creatinine level \leq 1mg/dl and 28% had serum creatinine level from 1.1 to 2.0mg/dl. All others had creatinine level more than 2mg/dl. The mean (SD) of serum PT INR was 1.96 (1.3). About 28% had serum PT INR level \leq 1 and 40% had serum PT INR level from 1.1 to 2.0. All others had PT INR level more than 2. The mean (SD) of serum albumin was 3.05mg/dl (0.92). About 16% had serum albumin level \leq 2mg/dl and 36% had serum albumin level from 2.1 to 3.0mg/dl. All others had albumin level more than 3mg/dl.

[Figure 1] depicts the resistive index. About 60% had resistive index of \leq 0.7 and 40% had resistive index of $>$ 0.7.

[Table 4] depicts the hepatic score. The mean (SD) of MELD score was 18.32 (12.18). About 30% had child pugh score as 5A, 28% had 7B, 8% had 8B, 6% had 9B, 6% had 10C, 2% had 11C, 2% had 12C, 18% had 13C, 6% had 14C and 8% had 15C.

[Table 5] depicts the comparison of resistive index with other hepatic scores. The resistive index showed positive strong correlation (0.903) with MELD score ($<$ 0.001). The resistive index showed positive strong correlation (0.873) with Child Pugh score ($<$ 0.001). The resistive index showed statistically significant association with form of cirrhosis and mortality ($<$ 0.001).

Table 1: Demographic details

S. No	Variable	Category	N (%)
1	Age group	≤30 years	6 (12%)
		31-35 years	7 (14%)
		36-40 years	20 (40%)
		>40 years	17 (34%)
		Mean (SD)	38.3 years (6.4 years)
2	Gender	Male	36 (72%)
		Female	14 (28%)

Table 2: Etiology and clinical findings

S. No	Variable	Category	N (%)
1	Etiology	Alcohol	26 (52%)
		Hepatitis B	13 (26%)
		Cryptogenic	9 (18%)
		Autoimmune	1 (2%)
		Wilson disease	1 (2%)
2	Ascites	Grade 2	14 (28%)
		Grade 3	21 (42%)
		No	15 (30%)
3	Hepatic encephalopathy	Grade I	1 (2%)
		Grade II	2 (4%)
		Grade III	4 (8%)
		Grade IV	1 (2%)
		None	42 (84%)
4	Form of cirrhosis	Compensated	15 (30%)
		Decompensated	35 (70%)
5	Patient condition	Alive	42 (84%)
		Dead	8 (16%)

Table 3: Laboratory findings

S. No	Variable	Category	N (%)
1	Serum bilirubin	≤1	7 (14%)
		1.1-2.0	14 (28%)
		2.1-4.0	12 (24%)
		4.1-7.0	11 (22%)
		>7.0	6 (12%)
		Mean (SD)	3.56 (3.01)
2	Serum creatinine	≤1	26 (52%)
		1.1-2.0	14 (28%)
		2.1-4.0	6 (12%)
		4.1-7.0	4 (8%)
		>7.0	0 (0%)
		Mean (SD)	1.5 (1.33)
3	PT INR	≤1	14 (28%)
		1.1-2.0	20 (40%)
		2.1-4.0	10 (20%)
		>4.0	6 (12%)
		Mean (SD)	1.96 (1.3)
4	Serum albumin	≤2	8 (16%)
		2.1-3.0	18 (36%)
		3.1-4.0	14 (28%)
		>4.0	10 (20%)
		Mean (SD)	3.05 (0.92)

Table 4: Hepatic scores

S. No	Variable	Category	N (%)
1	MELD score	≤10	15 (30%)
		11-15	14 (28%)
		16-25	7 (14%)
		26-40	11 (22%)
		>40	3 (6%)
		Mean (SD)	18.32 (12.18)
2	Child Pugh score	5A	15 (30%)
		7B	7 (14%)
		8B	4 (8%)
		9B	3 (6%)
		10C	3 (6%)
		11C	1 (2%)
		12C	1 (2%)
		13C	9 (18%)

	14C	3 (6%)
	15C	4 (8%)

Table 5: Comparison of resistive index with other hepatic scores and condition of patient

S. No	Resistive index	MELD score		Correlation coefficient	p value
		Mean	SD		
1	≤0.7	9.5	2.53	0.903	<0.001*
	>0.7	31.5	8.12		
		Child pugh score		Correlation coefficient	p value
		Mean	SD		
2	≤0.7	6.43	1.61	0.873	<0.001*
	>0.7	13.1	1.48		
		Compensated	Decompensated	p value	
3	≤0.7	12	18	<0.001*	
	>0.7	3	17		
		Dead	Alive	p value	
4	≤0.7	0	30	<0.001*	
	>0.7	8	12		

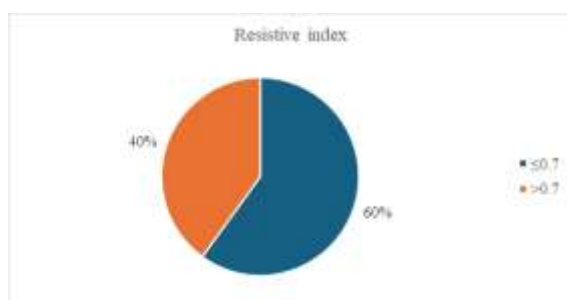


Figure 1: depicts the resistive index.

DISCUSSION

The study was conducted among 50 liver cirrhosis patients. The results were discussed below. The mean (SD) age of the patients is 38.3 years (6.4). Most of them belong to 36 to 40 years of age. Most of them were males (72%). The study done by Prabakar et al,^[1] showed that most of the patients were males. The study done by Surya et al,^[6] showed that most of the patients were males and mean age is around 49 years.

Most of them had alcohol etiology (52%), followed by hepatitis B infection (26%), cryptogenic etiology (18%), autoimmune etiology (2%) and Wilson disease (2%). About 70% had ascites and 16% had hepatic encephalopathy. About 30% had compensated disease and 70% had decompensated disease. About 16% were dead. The study done by Prabakar et al,^[1] showed that ascites and hepatic encephalopathy was reported similar to our study. The study done by Ramana et al,^[4] and Surya et al,^[6] showed that alcohol etiology is most common.

The mean (SD) of serum bilirubin was 3.56mg/dl (3.01). Only 14% had serum bilirubin level ≤1mg/dl. About 28% had serum bilirubin level from 1.1 to 2.0mg/dl. All others had bilirubin level more than 2mg/dl. The mean (SD) of serum creatinine was 1.5mg/dl (1.33). About 52% had serum creatinine level ≤1mg/dl and 28% had serum creatinine level from 1.1 to 2.0mg/dl. All others had creatinine level more than 2mg/dl. The mean (SD) of serum PT INR was 1.96 (1.3). About 28% had serum PT INR level ≤1 and 40% had serum PT INR level from 1.1 to 2.0.

All others had PT INR level more than 2. The mean (SD) of serum albumin was 3.05mg/dl (0.92). About 16% had serum albumin level ≤2mg/dl and 36% had serum albumin level from 2.1 to 3.0mg/dl. All others had albumin level more than 3mg/dl. The study done by Prabakar et al,^[1] showed mean serum bilirubin as 3.17mg/dl, mean serum albumin as 3.41 and mean INR as 2.1. The findings were similar to our study. The study done by Ramana et al,^[4] and Surya et al,^[6] showed similar findings.

About 60% had resistive index of ≤0.7 and 40% had resistive index of >0.7. The mean (SD) of MELD score was 18.32 (12.18). About 30% had child pugh score as 5A, 28% had 7B, 8% had 8B, 6% had 9B, 6% had 10C, 2% had 11C, 2% had 12C, 18% had 13C, 6% had 14C and 8% had 15C. The study done by Ramana et al,^[4] and Surya et al,^[6] showed similar findings of MELD and Child Pugh score.

The resistive index showed positive strong correlation (0.903) with MELD score (<0.001). The resistive index showed positive strong correlation (0.873) with Child Pugh score (<0.001). The resistive index showed statistically significant association with form of cirrhosis and mortality (<0.001). The study done by Prabakar et al,^[1] showed that RI was associated with liver cirrhosis and can be used as potential predictor for early detection and monitoring of patients with risk of renal dysfunction. The study done by Ramana et al,^[4] and Surya et al,^[6] showed similar findings. The study done by Götzberger et al,^[7] showed that RI was associated with mortality. The study by Regmi et al,^[8] Sundeep Goyal et al,^[9] and Sikarwar et al,^[10] concluded that RI showed good correlation with liver cirrhosis and can be used as non-invasive tool for evaluation of renal hemodynamic changes.

CONCLUSION

RI is not inferior in sensitivity and specificity to the existing hepatic scoring systems like MELD and CTP SCORE. MELD score is based on easily measured variables (prothrombin time, bilirubin and creatinine). Serum creatinine is an indicator of impaired renal function. however, it has

disadvantages as it depends on muscle mass and physical activity. Therefore, renal function based on serum creatinine can be overestimated in patients with advanced cirrhosis.

Thus, it is still necessary to develop improved prognostic markers feasible in daily practice. Our study confirms that the RI, based on sonographic measurements of intrarenal resistance, is an effective, non-invasive, economical functional test that provides useful information for the prognosis and management of cirrhotic patients. Elevated RIs may even disclose progress of the liver disease before changes in laboratory results. Therefore, the RI may help identify a subgroup of high-risk patients with a poor prognosis that require special therapeutic care.

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