



## A STUDY ON DOPPLER PARAMETERS OF HEPATIC ARTERY AND SEVERITY OF LIVER DISEASE

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### ABSTRACT

**Aim:** To compare the Doppler parameters such as Hepatic artery Pulsatile indices (PI) and Resistive indices (RI) with clinical and Histological parameters in cirrhotics patients to assess the severity of liver disease.

**METHODS:** This is a prospective study done in Department of Medical Gastroenterology in Rajiv Gandhi Government General Hospital Chennai. The study was carried during the period June 2013- March 2014. Patients with compensated cirrhosis involved in the study. Patients with comorbid conditions such Intrinsic Renal disease, Diabetes and Hypertension were excluded. Patients with serum creatinine more than 1.4 mg. Patients with malignancy. Doppler parameters such as HI and RI were assessed in all patients. Clinical and Histological parameters were also assessed. Statistical analysis was done by SPSS 16 software. **RESULTS** In our prospective study, total of 30 pts of compensated cirrhosis were enrolled. There were 23 males and 7 females. The mean age of presentation was 45.3 years. Pulsatile index and Resistive indices of Hepatic artery calculated. After evaluation of coagulation profile, these pts were subjected to liver biopsy. Total no of pts enrolled in this study was 30. Out of this, persons in age group 20- 40 were 10.33%. Those in age group 40- 65 accounted to about 20.67%. Mean age of patients was 45.3 years. In the 30 pts enrolled, 23 were males and 7 were females. In our study 24 out of 30 had episode of UGI bleed, other 6 were non bleeders. The median Hemoglobin was 9.3 gm%. The average platelet count was 63,900. The patients were subjected to OGD scopy, 26 pts had varices ranging from Gr1-3. 4 had no varices. The average Hepatic artery PI was 2.1997 and RI was 0.6910.

**Conclusion:** Our study also showed significant correlation between AST & HA -PI. The inference from our study was higher the Pulsatile index, higher is the AST and more is severity of fibrosis and liver disease. We also found no correlation between platelet count and HA-PI in our study.

**KEYWORDS :** Cirrhosis, Doppler hepatic artery, Pulsatile index, Resistive, Index

**Background:** Cirrhosis is a diffuse process characterized by fibrosis and conversion of normal liver into abnormal nodules. Cirrhosis is most common cause of Portal Hypertension (PHT). Cirrhosis characterized by alteration in systemic and splanchnic hemodynamics. Alteration of these hemodynamics leads to Portal Hypertension<sup>1</sup>. There are various methods to assess portal hypertension. Liver biopsy is the gold standard for diagnosis of portal hypertension. Non invasive methods for assessment include Doppler Ultrasonography, Hepatic vein pressure gradient, splenic pulp pressure, portal vein pressure, Endoscopic variceal pressure.<sup>2</sup> Doppler ultrasonography is inexpensive and noninvasive tool to assess focal and diffuse parenchymal changes in liver<sup>3,4</sup>. Investigators documented increase in renal resistance in cirrhotics. Doppler parameters correlate with complications of portal hypertension. These doppler parameters used for assessment of prognosis and response to pharmacological treatment. Hepatic artery and Renal artery Resistive index (R) and Pulsatile index (PI) were studied by Rivolta et al<sup>5</sup> Higher the Hepatic artery Resistive indices the more severe is the ascites and increased complications. RI is inversely related to organ perfusion. **Gaiani et al<sup>6</sup>** noted that spontaneous hepatic encephalopathy more frequent in patients with hepatofugal flow in the portal system (21% vs. 7.2%;  $P < 0.05$ ). **Sacerdoti et al<sup>7</sup>** showed that higher the RI in intrarenal arteries, predicts development of Hepatorenal syndrome and poor survival. Advantages of Doppler are safe, inexpensive and painless. Disadvantages it is operator dependent. Limitations of doppler are obesity, excess bowel gas and respiratory movement. Cirrhosis associated with increased intrahepatic resistance. It leads to increased resistance in main portal vein. **Wachsberg et al<sup>8</sup>** pointed out that the prevalence of hepatofugal flow varied between 3% and 23%. Child and Turcotte first introduced their scoring system in 1964 which was subsequently revised by Pugh in 1973. Child Turcotte Pugh (CTP) score is widely used for prognosis and for clinical correlation. Several studies correlated doppler parameters with ascites. There are few studies correlating Doppler parameters with Liver biopsy. This study carried to validate, correlate and to assess

the outcome. **Aim:** To compare the Doppler parameters such as Hepatic artery Pulsatile indices (PI) and Resistive indices (RI) with clinical and Histological parameters in cirrhotics patients to assess the severity of liver disease. **MATERIALS AND METHODS:** This is a prospective study done in Department of Medical Gastroenterology in Rajiv Gandhi Government General Hospital Chennai. The study was carried during the period June 2013- March 2014. Patients of Compensated cirrhosis were involved in the study. Inclusion criteria: Newly diagnosed cases of compensated cirrhosis were selected for study. Exclusion criteria: Patients with comorbid conditions such Intrinsic Renal disease, Diabetes and Hypertension were excluded. Patients with serum creatinine more than 1.4 mg. Patients with malignancy. Doppler parameters such as HAPI and HARI were assessed in all patients. Clinical and Histological parameters were also assessed. Statistical analysis was done by SPSS 16 software. **RESULTS:** In our prospective study, total of 30 pts of compensated cirrhosis were enrolled. There were 23 males and 7 females. The mean age of presentation was 45.3 years. Most patients presented without ascites, jaundice and hepatic encephalopathy. Patients were picked on routine screening. All were subjected to portal Doppler studies. Various Doppler parameters such as portal vein diameter, phasic variation, direction of flow and presence of collaterals were assessed. Peak systolic flow velocity and peak diastolic velocity assessed. From these values, Pulsatile index and Resistive indices of Hepatic artery calculated. After evaluation of coagulation profile, these pts were subjected to liver biopsy. Since the pts were of compensated cirrhosis all patients had F4 fibrosis using metavir scoring. In our study significant alcohol intake present in 23 patients. 7 had no history. Alcohol followed by Hepatitis B viral infection. 3 pts were found to be case of autoimmune hepatitis. Total no of pts enrolled in this study was 30. Out of this, persons in age group 20- 40 were 10.33%. Those in age group 40- 65 accounted to about 20.67%. Mean age of patients was 45.3 years. All the patients were subjected to complete blood count, blood urea, creatinine, electrolytes, liver function tests, prothrombin time, viral markers screening, portal Doppler parameters were assessed. In our study

24 out of 30 had episode of UGI bleed, other 6 were non bleeders. The median Hemoglobin was 9.3 gm%. The average platelet count was 63,900. The patients were subjected to OGD scopy, 26 pts had varices ranging from Gr1-3. 4 had no varices. The average Hepatic artery PI was 2.1997 and RI was 0.6910. The etiology was studied. Most common etiology was alcohol followed by Hepatitis B viral and Autoimmune hepatitis. Mean and standard deviation were calculated for various laboratory parameters. Mean Hb was 9 gm%. Average platelet count was 63,900. The average total protein of the patients was 7.2 gm. Average INR of patients was 1.05. portal Doppler was done in all patients. In Doppler, parameters such as peak systolic velocity, peak diastolic velocity were calculated. Using these parameters hepatic artery Resistive and pulsatile indices were correlated with clinical profile.

**Table:1**

	N	Min	Max	Mean	SD
Age in years	30	33	65	45.73	8.975
WBC	30	4300	9500	6063.33	1154.745
Hb	30	6.8	12.0	9.313	1.2451
Platelets	30	10000	1.29L	6.39L	21865.340
RBS	30	96	140	123.83	11.624
Urea	30	22	42	31.03	4.937
Creatinine	30	.6	1.2	.990	.1447
Na	30	130	143	136.03	3.577
K	30	3.4	4.5	3.900	.2626
Proteins	30	5.6	7.2	6.357	.4376
Albumin	30	2.9	4.5	3.677	.3928
AST	30	26.4	90.0	63.060	11.9258
ALT	30	36	70	47.57	8.990
Bilirubin	30	1.0	4.0	3.050	.9035
PT	30	14	19	17.08	1.422
INR	30	.8	1.5	1.059	.1919
HA RI	30	.60	.80	.6910	.05067
HA PI	30	1.68	2.72	2.1997	.38788

**Table:2**

HA RI	Pearson Correlation	.043
	Sig. (2-tailed)	823
	N	30
HA PI	Pearson Correlation	-.537(**)
	Sig. (2-tailed)	.002
	N	30

**Table:3**

	bleed UGI bleed	N	Mean	SD	SD error Mean
		N	Mean	Std. Deviation	Std. Error Mean
HA RI	Present	24	.6862	.05555	.01134
	Absent	6	.7100	.01265	.00516
HA PI	Present	24	2.1842	.39295	.08021
	Absent	6	2.2617	.39570	.16154

**Table:4**

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval	
									Lower	Upper
HA RI	Equal variances assumed	7.784	.009	-1.028	28	.313	-.023	.0231	-.07108	.02358
	Equal variances not assumed			-1.906	27	.069	-.023	.01247	-.04927	.00177
HA PI	Equal variances assumed	.600	.445	-.432	28	.669	-.077	.17958	-.44535	.29035
	Equal variances not assumed			-.430	27	.670	-.077	.18036	-.49657	.34157

**Discussion:** Various studies have used the Doppler parameters such as Resistive index (RI) and Pulsatile index (PI) and compared it with development of complication such as refractory ascites and response to diuretics. Liver cirrhosis is characterized by changes in portal and splanchnic circulation. Splanchnic vasodilation with increased resistance to portal venous blood flow occurs. Doppler ultrasonography has been noninvasive method for evaluation of portal and renal hemodynamics. Portal vein flow has been found low in those with responsive and refractory ascites than without ascites. Rivolta et al found that higher the Hepatic RI in cirrhotics the more severe is the ascites. Sacerdoti et al found that higher the RI more is the risk for development of Hepatorenal syndrome. RI is inversely related to organ perfusion. Colli et al agreed to the above findings<sup>9</sup>. Doppler sonography is safe and noninvasive. Most important disadvantage is it is highly operator dependent. In our study total of 30 patients were enrolled. There were 23 males and 7 females. History of alcohol intake was taken. It was consumed by 23 persons. Regarding etiology of chronic liver disease evaluated. Hepatitis B viral infection found in 9, autoimmune in 3 and alcoholic etiology in 18 patients. The mean age of patients in our study was 45.3 years. The average hemoglobin was 9.3 gm%. The platelet count was 63,900. The AST in our study is 63 IU. The patients underwent Doppler ultrasonography. Various parameters such as Hepatic artery RI and PI were assessed. These were calculated by measuring peak systolic velocity and peak diastolic velocity. There are many studies which found correlation of renal artery RI with development of PHT and esophageal varices. In our study we found no correlation of Hepatic artery RI and varices. However we found significant correlation between HA-PI and AST. These had significant p value of < 0.05 indicating HA-PI increase correlates with AST. The patients were subjected to liver biopsy after evaluating for coagulation profile. Since study population selected was compensated cirrhosis, all patients had F4 by using Metavir fibrosis score. The patients were screened for varices by upper gastrointestinal endoscopy and grading was done by Pacquet classification. Normal Doppler parameters of Hepatic artery are Resistive index 0.5 to 0.8 and Pulsatile Index -1.3 to 1.5. In our study Hepatic artery Pulsatile index was 2.1997. Resistive index was 0.6910. Using Chi square test statistical analysis carried out found to have significant p value of < 0.05. Moreover we also found correlation of PI with AST predictor of fibrosis. We also try to correlate platelet count with resistive and Pulsatile indices but we found no significant correlation between them. We also clinically assessed patients using CTP scores. But almost all cases were compensated cirrhosis and no jaundice was found. All case were in Child Pugh score of 5-6. We also tried to correlate between platelet count and development of varices found no significant association. Several studies have shown Pulsatile index to be better indicator of resistance<sup>10</sup>. We also found significant association between HA- PI and AST levels which is good indicator of fibrosis and resistance.

**Conclusion:** The inference from our study was higher the Pulsatile index, higher is the AST and more is severity of fibrosis and liver disease. Our study showed significant correlation between AST & HA -PI. We also found no correlation between platelet count and HA-PI in our study. In our study carried at Tertiary care hospital in southern part of India we found Alcohol as most common etiology followed by Hepatitis B viral infection. Average age of patients in our study was 45.3 years. We also carried out OGD screening and found increased Gr2 varices in our study population. From this study, we conclude that higher the HA-PI more is the severity of liver disease and AST found to correlate with these indices. Since the study population selected was compensated cirrhotics liver biopsy showed F4 fibrosis as per Metavir fibrosis score was seen in all cases, we were unable to carry out histological correlation

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