IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 19, Issue 6 Ser.5 (June. 2020), PP 56-61
www.iosrjournals.org

"Role of Duplex Ultra-Sonography in the Assessement of Portal Venous Hypertension Patients with Cirrhosis"

Dr. Hadi Hassan[1], Dr. Ravichandra.G[2], Dr. Devadas Acharya[3], Dr. Adarsh KM[4]
[1]*Senior Resident, department of radiology.*
[2]*Professor and HOD, department of radiology.*
[3]*Professor, department of radiology.*
[4]*Assistant Professor, department of radiology.*

Abstract:
Background and objective: *Portal hypertension is a frequently encountered clinical condition with multiple causes and severalsequelae. Duplex ultrasonography is best non-invasive test to assess portal hypertension. The objective was to evaluate the association between doppler findings of portal vein (direction of blood flow, the maximum portal vein velocity and the diameter of the main portal vein) and the presence or absence of ascites, splenomegaly, and presence of collaterals by ultrasound (US). To evaluate the association between Doppler findings and clinical features and laboratory investigations using Child Pugh's criteria*
Materials and Methods: *The study was hospital based cross sectional study. All patients referred to the department of radio-diagnosis of Yenepoya Medical College Hospital, Mangalore diagnosed with portal hypertension and also meeting the inclusion and exclusion criteria were considered for our study. This study was carried out over a period of 24months on 36 patients. They were divided into three groups using Child-Pugh criteria . All the patients were examined using a curvilinear probe of 3.5 – 5.0 MHZ coupled with color Doppler equipment, in ultrasound machine, Voluson E8.*
Results:*In our study the mean age of the patients was 45years. Maximum of the patients were in the 36-50 years age group which constitutes 61% of which 95.5% were of child's class C patients. Using one way ANOVA, there was a statistically significantly decreased levels of albumin (P < 0.036) from Child's A (4.5 ± 0.16g/100 mL) through Child's B (2.98 ± 0.25g/100mL)toChild'sC(2.31 ± 0.23g/100mL) group. In addition, there was a statistically significant increased levels of bilirubin (P < 0.0046) and INR (P < 0.0479) from Child's A through Child's B to Child's C group.*

Date of Submission: 26-05-2020 Date of Acceptance: 13-06-2020

I. Introduction

Portal hypertension syndrome represents the common evolutive complication of several hepatic and extra-hepatic diseases, liver cirrhosis which accounts for more than 80% of cases.

Portal hypertension when diagnosed has a prognostic value because of its high incidence of hemorrhagic, metabolic and infectious complications which the patients may develop,[1] so clinical suspicion should be confirmed with objective complementary studies that can provide information about the etiology and severity of the disease which helps in timely implementation of surgical / medical management and can prevent the complications.[1]

Portal hypertension is classified as intra-hepatic, extra-hepatic and hyperdynamic, [2] or sinusoidal, pre and post sinusoidal. Accurate diagnosis by imaging modality will help in the prompt treatment of the disease, therefore Ultrasound (US) is the first imaging modality used for assessing the hepatic parenchyma and vasculature in those patients with portal hypertension.[3]

Ultrasonography with Colour Doppler will help in evaluation of portal hypertension. Ultrasonography permits the differentiation of causes of portal hypertension into sinusoidal, pre or post sinusoidal which is helpful in providing information about the hemodynamics and morphology of portal hypertension. It also helps in to check for sequelae like portal vein thrombosis and collaterals with reasonable accuracy.

Accessibility, noninvasiveness, no ionization, portable nature, reliability, low cost and also its ability of rapidly accomplishment makes it good diagnostic tools, which plays a great role in the diagnosis and follow up of patients with portal hypertension.[4]Hence purpose of my study is to evaluate role of Duplex Ultrasonography in portal hypertension.

II. Objective Of The Study:

1. To evaluate the association between doppler findings of portal vein (direction of blood flow, the maximum portal vein velocity and the diameter of the main portal vein) and the presence or absence of ascites, splenomegaly, and presence of collaterals by ultrasound (US).
2. To evaluate the association between Doppler findings and clinical features and laboratory investigations using Child Pugh's criteria.

III. Methodology:

The study was hospital based cross sectional study. All patients referred to the department of radio-diagnosis of Yenepoya Medical College Hospital, Mangalore diagnosed with portal hypertension and also meeting the inclusion and exclusion criteria were considered for our study. This study was carried out over a period of 24months on 36 patients. They were divided into three groups using Child-Pugh criteria . All the patients were examined using a curvilinear probe of 3.5 – 5.0 MHZ coupled with color Doppler equipment, in ultrasound machine, Voluson E8.

Table 1: Child Pugh's Scoring System

	1 Points	2 Points	3 Points
Encephalopathy	None	Grade 1-2	Grade 3-4
Ascites	Absent	Slight	Moderate
Total bilirubin, (mg/dL)	< 2.0	2.0-3.0	> 3.0
Serum albumin, (g/dL)	> 3.5	2.8 - 3.5	< 2.8
Prothrombin time, s	< 4	4-6	> 6
prothromibin time, INR [a], s	< 1.7	1.7-2.3	> 2.3

Table 2:Child Pugh Grades of Encephalopathy and Class Scoring

Grades of Encephalopathy
0: Lack of detectable changes in personality or behaviour. No asterixis is detected.
1: Trivial lack of awareness, shortened attention span, sleep disturbance and altered mood. Asterixis may be present.
2: Lethargy, disorientation to time, amnesia of recent events, impaired simple computations, inappropriate behaviour, slurred speech. Asterixis is present.
3: Somnolence, confusion, disorientation to place, bizarre behaviour, clonus, nystagmus, positive Babinski sign. Asterixis usually absent.
4: Coma and lack of verbal, eye and oral response.

Child Pugh Scoring Classes
Class A: 5-6 points
Class B: 7-9 points
Class C: 10-15 points

Inclusion criteria

All cases coming to the department of radio-diagnosis of Yenepoya Medical College Hospital, Mangalore diagnosed with portal hypertension

Exclusion criteria

- Patients with grade 3 and 4 encephalopathy were excluded because of inability to fully cooperate in the examination
- Paediatric age group
- Pregnant women
- Patients from whom consent has not been obtained.

Sample size (including sample size calculation and justification)
Sample size (n)=$Z^2_{1-\alpha/2}pq \div d^2$
At the level of significance α=5%
P(prevalence) = 42%
q=1-p
d(absolute precision)= 16%
n= 36

IV. Results

This study was conducted in the Department of Radio diagnosis, Yenepoya Medical College, Mangalore, The study comprised of a total of 36 patients.

TABLE 3: Age Distribution of the Subjects in Different Child's Class

	Cases, No.	Child's A,No.	Child's B,No.	Child's C, No.
20-35	5(14%)	0	1	3
36-50	22(61%)	1	1	21
51-65	9(25%)	0	4	5
Total	36(100%)	1	6	29

TABLE 4: Gender Distribution of the Subjects in Different Child's Class

	Cases, No.	Child's A, No.	Child's B, No.	Child's C, No.
Male	34(94.6%)	1	5	28
Female	2(5.6%)	0	1	1
Total	36(100%)	1	6	29

TABLE 5: Portal vein diameter of the subjects in different child's Class

	Cases, No.	Child's A, No.	Child's B, No.	Child's C, No.
<= 13 mm	**16(44.4%)**	**1**	**2**	**13**
> 13 mm	**20(55.6%)**	**0**	**4**	**16**
Total	**36**	**1**	**6**	**29**

Table 6: Pattern of flow in the main portal vein in Child's Class

	Overall, No.	Child's A, No.	Child's B, No.	Child's C, No.
Hepatopetal	**29(80.6%)**	**0**	**6**	**23**
Hepatofugal	**3(8.3%)**	**0**	**0**	**3**
Thrombosis	**4(11.1%)**	**1**	**0**	**3**

Table 7: Comparison of Average Peak Venous Velocity in the Main Portal Vein in Child's A, B and C Groups with hepatopetal flow

	Patients, No.	Average PVV cm/sec
Total	29	13.8
Child's A	0	0
Child's B	6	14.8
Child'sC	23	13.6

*P value for B < 0.0491 and for C < 0.0323.

In our study out of 36 patients who had cirrhosis of liver with portal hypertension 23 of them belonged to the advanced disease class of Child's C, who showed an average peak venous velocity of the portal vein to be 13.6 cm/sec. while Child's B showed an average peak venous velocity of 14.8cm/sec, which concludes that advanced disease show a significant low peak venous velocity of the portal vein.

Table 9:Presence of Collaterals in Child's A, B and C Groups.

Collaterals	Cases, No.	Child's A, No.	Child's B, No.	Child's C, No.
Present	**26(72.2%)**	**1**	**5**	**20**
Absent	**10(27.8%)**	**0**	**1**	**9**
Total	**36**	**1**	**6**	**29**

Table 10: Laboratory parameters in child's A, B and C with correlative p value

	Overall	Child's A	Child's B	Child's C
Albumin, mg/100 mL, Mean ± SD	**2.48 ± 0.79**	**4.5 ± 0.16**	**2.98 ± 0.25**	**2.31 ± 0.23**
Bilirubin, mg/100 mL, Mean ± SD	**5.34 ± 2.43**	**1.5 ± 0.23**	**2.1 ± 0.21**	**6.1 ± 2.33**
INR , Mean ± SD	**1.71 ± 0.65**	**1.6 ± 0.5**	**1.67 ± 0.57**	**2.0 ± 0.30**

Using one way ANOVA, there was a statistically significant decrease of albumin levels ($P <$ 0.036) from Child's A (4.5 ± 0.16g/100 mL) through Child's B (2.98 ± 0.25g/100mL)toChild'sC(2.31 ± 0.23g/100mL) group. In addition, there was a statistically significant increase in bilirubin levels and INR from Child's A through Child's B to Child's C group.

Table 11: Distribution of Laboratory and Clinical Parameters in Patients with Hepatopetal and Hepatofugal Flow

	Hepatofugal	Hepatopetal
Albumin, mg/100 mL, Mean ± SD	2.1 ± 0.13	2.38 ± 0.42
Bilirubin, mg/100 mL, Mean ± SD	12.4 ± 0.27	4.91 ± 1.64
INR , Mean ± SD	1.8 ± 0.2	1.69 ± 0.4
Encephalopathy, No (%)	2(66.7)	3(10.35)
Ascites, No (%)	3(100)	27(93.1)

Usingoneway ANOVA, significantfallinthe average PVV from Child's B to Child's C group patients was noted. Hence significant fallin PVV was noted withincreasingseverityofthecirrhosis grade. Hepatofugalflowpatientshadsignificantlyhigher bilirubin levels, significantly lower albumin levelsand also significantly prolonged INR as compared to those patients withhepatopetalflow.Encephalopathyandasciteswere also more common in patients with hepatofugalflow,but that was not stastically significant.

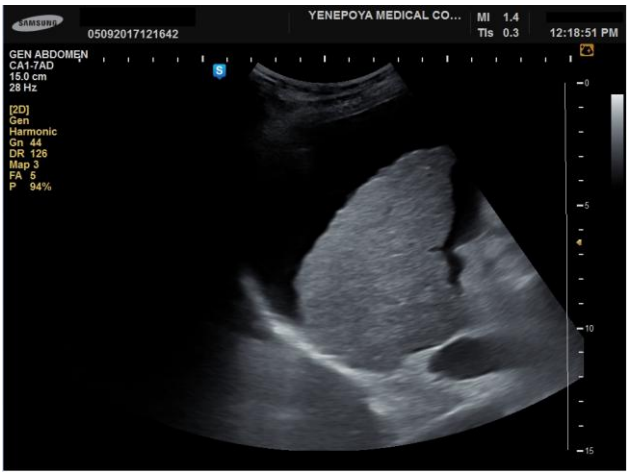

FIG. 8: SHRUNKEN LIVER WITH SURFACE NODULARITY

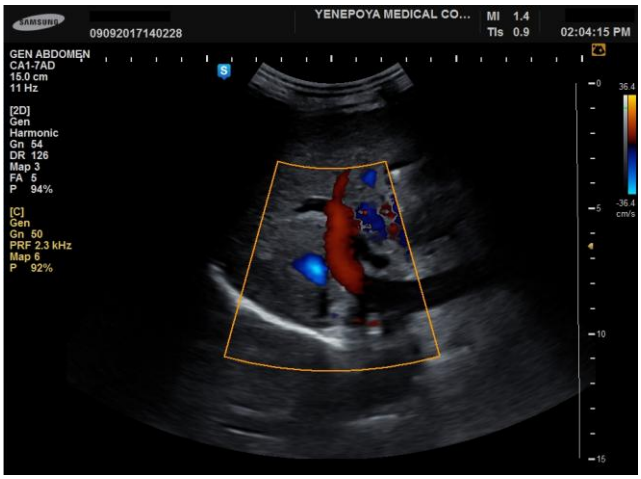

FIG. 13: HEPATOPETAL FLOW OF BLOOD IN THE PORTAL VEIN

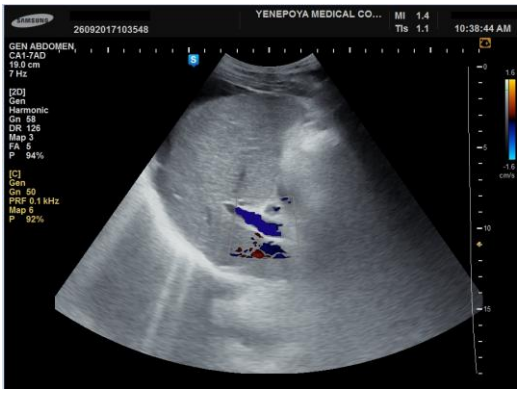

FIG. 14: HEPATOFUGAL FLOW OF BLOOD IN THE PROTAL VEIN.

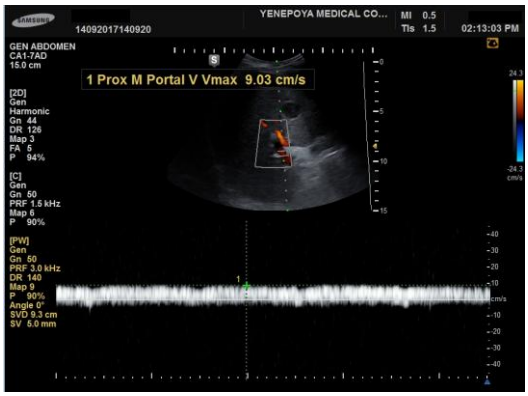

FIG. 15: REDUCED PEAK VENOUS VELOCITY IN THE PORTAL VEIN

V. Discussion

Cirrhosis represents the final result of a varietyofinsultstotheliverandit is an importantcause of portal hypertension. In assessing the prognosis the Child'sclassificationmodifiedbyPugh*etal* hasbeen avaluableindicatorofprognosis.Study ofhemodynamics of the portal vein isimportantasitprovidesinsightintothepathophysiologyof thediseasewhich helps to explorenewtherapeuticalternatives.

In our study the mean age of the patients was 45years. Maximum of the patients were in the 36-50 years age group which constitutes 61% of which 95.5% were of child's class C patients. Patients under 51-65 years of age group were 25% and that of 20-35 years were 14%. 94.6% percent of the patients were men compared to the 5.6% of females. Child'sCgrouphad maximum number of thepatients(80.5%) in our study.

Using one way ANOVA, there was a statistically significantly decreased levels of albumin ($P <$ 0.036) from Child's A (4.5 ± 0.16g/100 mL) through Child's B (2.98 ± 0.25g/100mL)toChild'sC(2.31 ± 0.23g/100mL) group. In addition, there was a statistically significant increased levels of bilirubin and INR from Child's A through Child's B to Child's C group.

In our study out of the 36 patients 20 patients had a dilated portal vein of greater than 13mm compared to the 16 patients with a portal vein diameter of less than or equal to 13mm. of which majority of the patient (16 patients) with advanced child's score (child's C) had dilated portal vein.

Overallsevenpatientsamongatotalofthirty sixhadabsent flow or hepatofugal flow in which four of them showed absent (thrombosed) flow and three patients showed hepatofugal flow. Hepatofugal flows were only seen in Child's C group patients. UsingonewayANOVA,significantdecreaseinthe average peak venous velocity from Child's B to Child's C group patients was observed. Hence significant fallin peak venous velocity was noted withincreasingseverityofthecirrhosis grade. Patientswith hepatofugalflowhadsignificantlyelevated bilirubin levels, significantly reduced albumin levelsand also significantly prolonged INR as compared to those patients withhepatopetalflow.Encephalopathyandasciteswere also more common in patients with hepatofugalflow,but that was not stastically significant.

As expected, patient with hepatofugal flow had a significantly higher Child's score in comparison to patients with hepatopetal flow.

In our study Child's Aclass patient had absent flow in the portal vein. In the Child's B group,

allthe patients had hepatopetal flow and none of them had hepatofugal flow. While hepatofugal flow was only detected in child's C group patient.Similar results have been seen in the study by Von Herbay*et al*.[5] Onthewhole,theincidenceofnonhepatopetalflowwas28.5%inChildCcirrhosisgroupwith19%ofthepatients showing total hepatofugal flow.Similar observation was made by Gaiani*etal*.[6]alsoobservedthehepatofugalflowtobemoreprevalentinpatientswithChild'sBandCthanthose withChild'sA and B cirrhosis.Inthepresentstudy, patient with hepatofugalflow had significantly higher Child's score comparedwithpatients with hepatopetal flow. Ourstudyshowsthattheprevalenceofreversedflow has a significantly higher child' score which indicatesthatreversal of flow, results in significant impairment of liver function which in turn results in poor Child's score. It also showed that as there is progressive damage to the liver parenchyma, consequently there is increase of intrahepatic resistance. In our study, among three patients with hepatofugal flow, encephalopathy was present in two patients (66.7%), while in patients with hepatopetalflow,encephalopathywasseeninonly10.3%ofthe patients. Gaiani*et al*.[6] also showed that spontaneous hepatic encephalopathy was significantly more common in patients with hepatofugal flow in the portalvein(21%*vs*.7.2%).

In our study out of 36 patients 77.8% of the patient had splenomegaly compared to the 22.2% without splenomegaly, which implies that splenomegaly is a common imaging finding in portal hypertension.

Cirrhosisischaracterizedbyextensive fibrosis and numerous regenerative nodules which replaces thenormalliverparenchyma.SoincreaseinChild'sgradeofcirrhosis will in turn increase the resistance to portal flow. This increase in the resistance of the flow in the portal vein is manifested as reduced PVV in the portal vein with increasing severity of the cirrhosis.

In our study, the average of peak venous velocities in the main portal vein were studied in Child's A, B and C cirrhosis patients with a hepatopetal flow. Of the 29 patients with hepatopetal flow, the average peak velocity in 6 patients withChild'sBcirrhosiswas14.8cm/sec,and that of 23 patients with Child's C cirrhosis was 13.6cm/sec.The average peak portal velocity in the Child's C cirrhosis group was observed to be significantly lesser than that of the Child's B cirrhosis group. Trends similar to our study have been reported in the literature [7-9].

Puneet Mittal stated hepatofugal flow was common as there is advanced child's class. In the study Child's A and Child's B group patients, none of them had hepatofugal flow. In the Child's C cirrhosis group, four patients had hepatofugal flow and two patients had bidirectional flow. In this study, significant higher Child's score was found in patients with hepatofugal flow compared with patients with hepatopetal flow. The study also concluded that prevalence of reversed flow was significantly high in patients with Child's C cirrhosis. Similarly, the Child's score was significantly higher in patients with a reversed flow. It was observed that the average peak portal velocity in the Child's B cirrhosis group was significantly lower than that in the Child's A group. In addition, the average peak velocity in the Child's C cirrhosis group was significantly lower than that in the Child's B cirrhosis. It was also found that presence of ascites usually indicates a more advanced Child's grade of cirrhosis and they have already observed that the increase in Child's grade of cirrhosis is associated with a statistically significant decrease in the peak portal velocity. In this study, one or more collateral varices were detected in 42 of 50 (84%) patients. Splenic varices were the most common type of collaterals detected in this study. Hepatofugal flow was only seen among patients with splenic varices (4 of 41 patients, 9.76%). [10]

References:

[1]. Fernandez PFJ, García MJM, Castro LL, Martin GJM, Jimenez SM, Herrerías GJM. Usefulness of ultrasonography in the diagnosis of portal hypertension.RevEspEnferm Dig. 1998Nov;90(11):806-812.

[2]. Pellerito JS, Polak JF. Ultrasound Assessment of the hepaticvasculature.In:Introduction to vascular ultrasonography. 6th ed. Elsevier Inc; 2012.p.495-515.

[3]. Demosthenes D, Cokkinos, Spyridon P. Dourakis. Ultrasonographic Assessmentof Cirrhosis and Portal Hypertension,in: Current Medical Imaging Reviews, 2009, 5, 62-70.

[4]. Meire EB, Dewbury KC, Cosgrove DO. Abdominal and General Ultrasound.Churchill Livingstone. Edinburgh. 1993:1:311.

[5]. Von herbay a, Frieling T, Haussinger D. Color Doppler sonographic evaluation of spontaneous portosystemic shunts and inversion of portal venous flow in patients with cirrhosis. *J Clin Ultrasound*. 2000;**28**(7):332-9.

[6]. Zironi G, Gaiani S, Fenyves D, Rigamonti A, Bolondi Z, Barbara L: Value of measurement of mean portal flow velocity by Doppler flowmetry in the diagnosis of portal hypertension in: J Hepatol.1992 Nov;16(3):298-303 .

[7]. ChawlaY, Santa N, Dhiman RK, Dilawari JB. Portal hemodynam- ics by duplex Doppler sonography in different grades of cirrho- sis.*DigDisSci*.1998;**43**(2):354-7.

[8]. VyasK,GalaB,SawantP,DasHS,KulhalliPM,MahajanSS.Assess- ment of portal hemodynamics by ultrasound color Doppler and laser Doppler velocimetry in liver cirrhosis. *Indian J Gastroen- terol*.2002;**21**(5):176-8.

[9]. ShiBM,WangXY,MuQL,WuTH,XuJ.Valueofportalhemody- namics and hypersplenism in cirrhosis staging. *World J Gastroenterol*.2005;**11**(5):708-11.

[10]. Puneet M, Ranjana G, Gaurav M, Vishal K. Association between portal vein color Doppler findings and the severity of disease in cirrhotic patients with portal hypertension. Iranian Journal of Radiology. 2011 Dec;2011(4):211-7.