

# ASSESSMENT OF PLATELET COUNT AND DOPPLER ULTRASOUND ON HEPATIC AND SPLENIC VENOUS SYSTEM AS NON-INVASIVE PREDICTORS OF GASTRIC VARICES IN PATIENTS WITH LIVER CIRRHOSIS

By

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## ABSTRACT

**Background:** Gastric varices are probably associated with thrombocytopenia. However, the prevalence and severity of thrombocytopenia are unknown in this clinical setting.

**Objective:** To assess platelet count and doppler ultrasound on hepatic and splenic venous system as non-invasive predictors of gastric varices in patients with liver cirrhosis with no history of previous endoscopic or surgical intervention for portal hypertension.

**Patients and Methods:** An observational case control study was accomplished at Al-Azhar University Hospitals, Hepatogastroenterology and infectious diseases Departments, at Cairo from September 2018 to December 2019. One hundred and twenty patients with liver cirrhosis without past history of previous endoscopic or surgical intervention for portal hypertension were selected, and divided into three equal main groups: Group A: Cirrhotic patients without varices, Group B: Cirrhotic patients with esophageal varices only, and Group C: Cirrhotic patients with gastric varices, which divided into two subgroups: Group Ca: Six patients with isolated gastric varices and Group Cb: Thirty four patients with gastroesophageal varices. All patients were subjected to upper gastrointestinal endoscopy, complete blood picture (CBC) and abdominal Doppler ultrasonography study on hepatic and splenic venous systems.

**Results:** Group Cb recorded the highest values of splenic size ( $P < 0.001$ ), ascites ( $p = 0.006$ ), portal vein diameter ( $P < 0.001$ ) and collaterals ( $P < 0.001$ ) compared to other groups. Group Ca recorded the lowest values of the mean portal vein flow velocity (MPVV) ( $p < 0.001$ ), the mean splenic vein flow velocity (M.SVV) ( $P = 0.026$ ), and recorded the highest values of portal vein congestion index (P.CI) ( $P < 0.001$ ), portal vein thrombosis (PVT) ( $P < 0.001$ ), the mean values of the splenic vein diameter ( $P < 0.001$ ), cross sectional area of splenic vein ( $p < 0.001$ ), splenic vein congestion index (S.CI) ( $p < 0.001$ ), as well as abnormal blood direction in splenic vein ( $P = 0.019$ ) compared to other groups. Also, portal vein cross sectional area and the Child-Turcotte-Pugh score class "C" showed statistically significant difference ( $p < 0.001$ ) between group A which recorded the lowest value compared to group B which recorded the highest value. Also, platelet count recorded no statistically significant difference between the four groups.

**Conclusion:** Doppler ultrasound can be an easy, cheap and safe predictor of gastric varices, while platelet count has no any significance in predicting of gastric varices.

**Keywords:** Cirrhosis, platelet count, Doppler ultrasound, hepatic venous, splenic venous, gastric varices.

## INTRODUCTION

Chronic liver diseases impose a major burden in health systems. Although of different etiologies, they share common end stage namely liver cirrhosis with portal hypertension (PHT) (*Sauerbruch and Trebicka, 2014*). The most common cause of PHT is cirrhosis while vascular resistance and blood flow are the two important factors in its development (*Jesus, 2017*).

Portal hypertension (PHT) can cause a variety of pathologic changes along the entire gastrointestinal tract from the esophagus to the anus which manifest as varices, gastropathy, and enteropathy (*Di Giorgio and D'Antiga, 2019*).

Gastric varices (GV) are less prevalent than esophageal varices (EV) occurring in approximately 20% of patients with PHT with a reported incidence of bleeding of 10-30% of all variceal hemorrhages with a higher bleeding incidence for fundal varices. They are developed due to spontaneous portosystemic collaterals commonly between the splenic and gastric veins. Thus, gastric varices are commonly classified based on their relationship with esophageal varices as well as their location in the stomach (*Zeng et al., 2017*).

Patients with compensated cirrhosis and small varices with no high-risk stigmata may be considered for endoscopic variceal surveillance every 1–2 years to evaluate progression, in patients with advanced liver disease or medium or large varices, primary prophylaxis should be implemented (*Garcia-Tsao et al., 2017*).

Various noninvasive hematological, biochemical and ultra-sonographic predictors have been suggested which include splenic size, portal vein diameter, serum albumin levels and platelet count; all of these parameters are non-invasive and easy to perform (*DeFranchis and Faculty, 2015*).

Gastric varices primarily occur in cirrhotic patients with portal hypertension and splenomegaly and thus are probably associated with thrombocytopenia. However, the prevalence and severity of thrombocytopenia are unknown in this clinical setting (*Wael et al., 2014*).

Doppler ultrasonography (US) imaging is considered the first-line imaging technique in patients with cirrhosis. Portal vein diameter, portal blood velocity and congestion index, splenic size, flow pattern in the hepatic veins, and the presence of abdominal portosystemic collaterals are all US parameters previously thought to be associated with prognostic significance (*Rye et al., 2012*).

**This study aimed to** assess platelet count and doppler ultrasound on hepatic and splenic venous system as non-invasive predictors of gastric varices in patients with liver cirrhosis with no history of previous endoscopic or surgical intervention for portal hypertension.

## PATIENTS AND METHODS

An observational case control study accomplished at Al-Azhar university hospitals, Hepatogastroenterology and infectious diseases departments at Cairo according to the ethical board of Al-Azhar University from September 2018 to December 2019 where 120 patients aged more than 18 years old with liver cirrhosis

without past history of previous endoscopic or surgical intervention for portal hypertension were selected. Study information sheet was provided to patients and informed consents were written by patients who agreed to participate in this study.

Patients were divided into three equal main groups: Group A: Forty cirrhotic patients without varices, Group B: Forty cirrhotic patients with esophageal varices only and Group C: Forty cirrhotic patients with gastric varices, which divided into two subgroups, Group Ca with isolated gastric varices and Group Cb with gastroesophageal varices.

We excluded patients with previous endoscopic or surgical intervention for portal hypertension, patients with associated advanced co-morbidity (as advanced cardiac disease, renal disease, cancer liver ...etc) and patients refused to sign an informed consent.

All participants were subjected to full history taking and clinical examination including manifestations of chronic liver disease (such as jaundice, flapping tremors, lower limb edema, organomegaly, ascites), routine laboratory investigations including complete blood picture (CBC), Liver profile (aminotransferases (ALT&AST), serum albumin, total& direct bilirubin, prothrombin time and INR) and renal function tests (serum creatinine and blood urea), Child-Turcotte-Pugh score-classification, abdominal ultrasonography and doppler study with emphasis on: liver size (classified as shrunken <11 cm, average 11- 15 cm or enlarged >15 cm), criteria suggestive of chronic liver disease and cirrhosis, presence of periportal

thickening, splenic bi-polar diameter (normal up to 12-13 cm), ascites (reported as mild, moderate or marked ascites if present), portal vein indices including: portal vein diameter (PVD) and patency or thrombosis (PVT), cross sectional area (A), mean portal vein flow velocity (MPVV), congestion index of the portal vein ( $P.CI = A \text{ (cm}^2) / \text{mean PVV (cm/sec)}$ ) and direction of flow (hepatopetal, bidirectional or hepatofugal), splenic vein indices including: splenic vein diameter (mm) and patency, cross sectional area (A), mean splenic vein flow velocity (MSVV), congestion index of the splenic vein ( $S.CI = A \text{ (cm}^2) / \text{mean SVV (cm/sec)}$ ) and direction of flow (hepatopetal, bidirectional, hepatofugal), hepatic vein patency and dilation and presence of portosystemic collaterals, also upper gastrointestinal endoscopy was done to all participants to evaluate the presence of esophageal varices and its grade and the presence and type of gastric varices based upon Sarin classification.

**Statistical analysis:** Data were analyzed using Statistical Package for the Social Sciences (SPSS) version 21. Quantitative data were expressed as mean  $\pm$  standard deviation (SD), Also qualitative data were expressed as frequency and percentage.

**The following tests were done:**

- Chi-Square test ( $\chi^2$  value): It is used to compare between two groups or more regarding one qualitative variable.
- Fisher's exact test: It is used to compare between two groups regarding one qualitative variable in a 2 x 2 contingency table when the expected count of any of the cells less than 5.

- One-way ANOVA (F) test was used to compare more than two groups for continuous variables.
- Pearson correlation.
- Probability (P-value) P-value<0.05 was considered significant.
- Kruskal - Wallis test, Pairwise comparison between each to groups was done using Post Hoc test (Dunn, s for multiple comparison test).

## RESULTS

In this study, the age range of participants was from 18 to 72 years with a mean age  $\pm$  SD of (53.63 $\pm$ 9.05, 56.08 $\pm$ 7.72, 54.79 $\pm$ 10.71 and 54.79 $\pm$ 10.71 year) for group A, group B, group Ca and group Cb respectively, showing no statistically significant difference between

the four groups (p= 0.55). and the number of males within group A, group B, group Ca and group Cb were (24 (60%), 32 (80%), 4 (66.67%), and 25 (73.53%)) respectively, showing no statistically significant difference between the four groups (p= 0.25) (**Table 1**).

**Table (1): Comparison between the studied groups regarding age and sex**

Groups Parameters	Group A (n=40)		Group B (n=40)		Group Ca (n=6)		Group Cb (n=34)		P value
Age (years)									
Mean $\pm$ SD	53.63 $\pm$ 9.05		56.08 $\pm$ 7.72		57.83 $\pm$ 5.31		54.79 $\pm$ 10.71		0.55
Range	30-71		38-72		51-65		18-68		
	No	%	No	%	No	%	No	%	
Sex									0.25
Males	24	60.0	32	80.0	4	66.67	25	73.53	
Females	16	40.0	8	20.0	2	33.33	9	26.47	
Total	40	100.0	40	100.0	6	100.0	34	100.0	

$\chi^2$ : chi square, SD: standard deviation, Group A: cirrhotic patients without varices, Group B: cirrhotic patients with esophageal varices only, Group Ca: cirrhotic patients with isolated gastric varices Group Cb: cirrhotic patients with gastroesophageal varices.

The mean values of white blood cell counts (WBCs) were 7170 $\pm$ 2634, 11.90 $\pm$ 1.69, 10.39 $\pm$ 2.12 and 10.99 $\pm$ 1.98 in group A, group B, group Ca and group Cb respectively with statistically significant difference between

the four groups (P <0.001). The mean values of hemoglobin levels (HB) and Platelet counts in group A, group B, group Ca and group Cb showed no statistically significant difference between the four groups (**Table 2**).

**Table (2): Comparison between the studied groups regarding CBC results**

Parameters \ Groups	Group A (n=40)		Group B (n=40)		Group Ca (n=6)		Group Cb (n=34)		P-value
	No.	%	No.	%	No.	%	No.	%	
<b>Hb(g/dL)</b>									
Mean ±SD	11.59±1.93		11.90±1.69		10.39±2.12		10.99±1.98		0.098
Range	7.90-15.48		8.00-15.50		8.30-14.30		7.90-15.70		
<b>WBCs (cells/mm<sup>3</sup>)</b>									
Mean ±SD	7170±264		4904±2063		7214±2286		5542±2889		<0.001
Range	2890-12400		1800-10400		3900-10200		2100-13500		
<b>Significance between Groups</b>	p <sub>1</sub> =0.001*, p <sub>2</sub> =0.883, p <sub>3</sub> =0.003*, p <sub>4</sub> =0.036, p <sub>5</sub> =0.495, p <sub>6</sub> =0.087								
<b>Platelets (cells/mm<sup>3</sup>)</b>									
Mean ±SD	151525±50663		146200±55308		99517±94156		154382±87792		0.176
Range	67000-310000		59000-310000		102-279000		45000-527000		

SD: standard deviation, WBCs: white blood cells. Hb: hemoglobin, p<sub>1</sub>: p value for comparing between Group A and Group B, p<sub>2</sub>: p value for comparing between Group A and Group CA, p<sub>3</sub>: p value for comparing between Group A and Group CB, p<sub>4</sub>: p value for comparing between Group B and Group CA, p<sub>5</sub>: p value for comparing between Group B and Group CB, p<sub>6</sub>: p value for comparing between Group CA and Group CB

Concerning the Child-Turcotte-Pugh score classification of group A, group B, group Ca and group Cb the number of child,s class “A” patients was 21 (52.50%), 5 (12.50%), 1 (16.67%) and 7 (20.59%) respectively. The number of child,s class “B” patients was 10 (25.5%), 9 (22.50%), 2 (33.33%) and 8 (23.53%) respectively, and for the number of child,s

class “C” patients was 9 (22.50%), 26 (65.0%), 3 (50.0%) and 19 (55.88%) respectively, with statistically significant lower numbers of child,s class “C” patients (p<0.002) in the group A compared to other groups, and group B which showed the highest number (Table 3).

**Table (3): Comparison between Studied groups regarding Child-Turcotte-Pugh score classification**

Child's class \ Groups	Group A (n=40)		Group B (n=40)		Group Ca (n=6)		Group Cb (n=34)		p-value
	No.	%	No.	%	No.	%	No.	%	
A	21	52.50	5	12.50	1	16.67	7	20.59	<0.002*
B	10	25.00	9	22.50	2	33.33	8	23.53	
C	9	22.50	26	65.00	3	50.00	19	55.88	
<b>Total</b>	40	100.00	40	100.00	6	100.0	34	100.00	
<b>Significance between groups.</b>	p <sub>1</sub> <0.001*, p <sub>2</sub> =0.210, p <sub>3</sub> =0.006*, p <sub>4</sub> =0.555, p <sub>5</sub> =0.606, p <sub>6</sub> =0.845								

X<sup>2</sup>: chi square NS: non-significant, \*: significant, p<sub>1</sub>: p value for comparing between Group A and Group B, p<sub>2</sub>: p value for comparing between Group A and Group CA, p<sub>3</sub>: p value for comparing between Group A and Group CB, p<sub>4</sub>: p value for comparing between Group B and Group CA, p<sub>5</sub>: p value for comparing between Group B and Group CB, p<sub>6</sub>: p value for comparing between Group CA and Group CB.

Our study also revealed that regarding the mean values of the splenic size were  $13.72 \pm 1.92$ ,  $17.08 \pm 2.50$ ,  $16.92 \pm 4.25$  and  $17.53 \pm 3.31$  in group A, group B, group Ca and group Cb respectively, showing statistically significant difference of ( $P < 0.001$ ) in the group A which recorded the lowest value compared to group Cb which recorded the highest value. In the group A, ascites was mild in 11 patients (27.50%) and moderate in 6 patients (15.0%), while in the group B was mild in 21 patients (52.50%) and moderate in 13

patients (32.50%), while in the group Ca was mild in 1 patient (16.67%) and was moderate in 1 patient (16.67%), In the group Cb, it was mild in 9 patients (26.47%), moderate in 9 patients (26.47%) and marked in 2 patients (5.88%), showing statistically significant difference ( $p = 0.002$ ) in group Cb which recorded the highest value compared to other groups. Regarding liver size and periportal thickening, no statistically significant difference between the four groups (**Table 4**).

**Table (4): Comparison between Studied groups regarding trans-abdominal ultrasonographic findings**

Parameters \ Groups	Group A (n=40)		Group B (n=40)		Group Ca (n=6)		Group Cb (n=34)		P-value
<b>Splenic size(cm)</b>									
Mean $\pm$ SD	13.72 $\pm$ 1.92		17.08 $\pm$ 2.50		16.92 $\pm$ 4.25		17.53 $\pm$ 3.31		<0.001
Range	10.00-17.70		11.50-23.00		12.00-22.00		12.00-24.00		
<b>Significance between groups</b>	p <sub>1</sub> <0.001*, p <sub>2</sub> =0.038*, p <sub>3</sub> <0.001*, p <sub>4</sub> =0.999, p <sub>5</sub> =0.887, p <sub>6</sub> =0.955								
	No.	%	No.	%	No.	%	No.	%	
<b>Ascites</b>									
No	23	57.50	6	15.00	4	66.67	14	41.18	0.002
Mild	11	27.50	21	52.50	1	16.67	9	26.47	
Moderate	6	15.00	13	32.50	1	16.67	9	26.47	
Marked	0	0.00	0	0.00	0	0.00	2	5.88	
<b>Total</b>	40	100.0	40	100.0	6	100.0	34	100.0	
<b>Significance between groups</b>	p <sub>1</sub> <0.001*, p <sub>2</sub> =1.000, p <sub>3</sub> =0.235, p <sub>4</sub> =0.031*, p <sub>5</sub> =0.014*, p <sub>6</sub> =0.725								
<b>Liver size</b>									
Average	30	75.00	24	60.00	3	50.00	20	58.82	0.321
Shrunk	6	15.00	14	35.00	3	50.00	12	35.29	
Enlarged	4	10.00	2	5.00	0	0.00	2	5.88	
<b>Total</b>	40	100.0	40	100.0	6	100.0	34	100.0	
<b>Periportal thickening:</b>									
No	34	85.00	33	82.50	4	66.67	27	79.41	0.721
Yes	6	15.00	7	17.50	2	33.33	7	20.59	
<b>Total</b>	40	100.0	40	100.0	6	100.0	34	100.0	

X2: chi square NS: non-significant, SD: standard deviation, p1: p value for comparing between Group A and Group B, p2: p value for comparing between Group A and Group CA, p3: p value for comparing between Group A and Group CB, p4: p value for comparing between Group B and Group CA, p5: p value for comparing between Group B and Group CB, p6: p value for comparing between Group CA and Group CB.

The mean values of the splenic vein diameter (SVD) were  $9.98 \pm 1.36$ ,  $10.58 \pm 1.71$ ,  $12.92 \pm 0.88$  and  $11.94 \pm 2.01$  in group A, group B, group Ca and groupCb respectively, showing statistically significant difference ( $p < 0.001$ ) between group A which recorded the lowest value compared to group Ca which recorded the highest value. Splenic vein cross sectional area was found to be  $0.80 \pm 0.21$ ,  $0.90 \pm 0.29$ ,  $1.34 \pm 0.36$  and  $1.15 \pm 0.35$  in group A, group B, group Ca and groupCb respectively, showing statistically significant difference ( $p < 0.001$ ) between group A which recorded the lowest value compared to group Ca which recorded the highest value. M. SVV was found to be  $13.58 \pm 2.15$ ,  $12.94 \pm 1.70$ ,  $11.17 \pm 2.23$  and  $12.43 \pm 2.56$  in group A, group B, group Ca and groupCb respectively, showing statistically significant difference ( $p = 0.026$ ) between group Ca which

recorded the lowest value compared to group A which recorded the highest value. Splenic vein congestion index (S.CI) was found to be  $0.06 \pm 0.02$ ,  $0.07 \pm 0.02$ ,  $0.12 \pm 0.02$  and  $0.09 \pm 0.02$  in group A, group B, group Ca and groupCb respectively, showing statistically significant difference ( $p < 0.001$ ) between group A which recorded the lowest value compared to group Ca which recorded the highest value. The direction of flow in splenic vein was found to be normal in all patients in group A, and it was abnormal in 3 patients (7.5%) in group B, 2 patients (33.33%) in group Ca and 4 patients (11.76%) in group Cb, showing statistically significant difference ( $p = 0.019$ ) of abnormal blood direction between group A which recorded the lowest value compared to group Ca which recorded the highest value (**Table 5**).

**Table (5): Comparison between Studied groups regarding trans-abdominal doppler ultra-sonographic findings of splenic vein (SV)**

Parameters	Group A (n=40)		Group B (n=40)		Group Ca (n=6)		Group Cb (n=34)		P value
<b>Splenic vein diameter (SVD)(mm)</b>									
Mean ±SD	9.98 ±1.36		10.58±1.71		12.92±.88		11.94±2.01		<0.001
Range	6.00-12.50		7.50-15.00		9.50-15.00		5.00-15.00		
<b>Significance between groups</b>	p <sub>1</sub> =0.397, p <sub>2</sub> =0.001*, p <sub>3</sub> <0.001*, p <sub>4</sub> =0.011*, p <sub>5</sub> =0.004*, p <sub>6</sub> =0.569								
<b>Splenic vein cross sectional area (cm<sup>2</sup>)</b>									
Mean ±SD	0.80±0.21		0.90±0.29		1.34±0.36		1.15±0.35		<0.001
Range	0.28-1.23		0.44-1.77		0.71-1.77		0.20-1.77		
<b>Significance between groups</b>	p <sub>1</sub> =0.129, p <sub>2</sub> =0.001*, p <sub>3</sub> <0.001*, p <sub>4</sub> =0.009*, p <sub>5</sub> =0.001*, p <sub>6</sub> =0.384								
<b>Mean splenic vein flow velocity (M.SVV) (cm/sec)</b>									
Mean ±SD	13.58 ±2.15		12.94±1.70		11.17±2.23		12.43±2.56		0.026
Range	9.33-19.75		10.00-17.33		7.89-14.75		6.67-17.11		
<b>Significance between groups</b>	p <sub>1</sub> =0.533, p <sub>2</sub> =0.045*, p <sub>3</sub> =0.101, p <sub>4</sub> =0.243, p <sub>5</sub> =0.740, p <sub>6</sub> =0.551								
<b>Splenic vein congestion index (SCI) (cm/sec)</b>									
Mean ±SD	0.06±0.02		0.07±0.02		0.12±0.02		0.09±0.02		<0.001
Range	0.03-0.09		0.04-0.13		0.09-0.14		0.03-0.13		
<b>Significance between groups</b>	p <sub>1</sub> =0.062, p <sub>2</sub> <0.001*, p <sub>3</sub> <0.001*, p <sub>4</sub> <0.001*, p <sub>5</sub> <0.001*, p <sub>6</sub> =0.177								
	No.	%	No.	%	No.	%	No.	%	
<b>Direction of flow in SV</b>									
Abnormal	0	0.00	3	7.5	2	33.33	4	11.76	0.019
Normal	40	100.0	37	92.5	4	66.67	30	88.24	
Total	40	100.0	40	100.0	6	100.0	34	100.0	
<b>Significance between groups</b>	p <sub>1</sub> =0.241, p <sub>2</sub> =0.014*, p <sub>3</sub> =0.040*, p <sub>4</sub> =0.120, p <sub>5</sub> =0.696, p <sub>6</sub> =0.215								

X2: Chi squar, SV: splenic vein.

SD: standard deviation.

p1: p value for comparing between Group A and Group B.

p2: p value for comparing between Group A and Group CA.

p3: p value for comparing between Group A and Group CB.

p4: p value for comparing between Group B and Group CA.

p5: p value for comparing between Group B and Group CB.

p6: p value for comparing between Group CA and Group CB.

Portal vein diameter (PVD) was found to be 13.32±1.06, 15.40±2.05, 14.50±3.35 and 15.32±1.81 in group A, group B, group Ca and group Cb respectively, showing statistically significant difference (p<0.001) between group A which recorded the lowest value compared to group Cb which recorded the highest

value. Portal vein cross sectional area was found to be 1.40±0.21, 1.89±0.59, 1.73±0.74 and 1.87±0.45 in group A, group B, group Ca and group Cb respectively, showing statistically significant difference (p<0.001) between group A which recorded the lowest value compared to group B which recorded the

highest value. M. PVV was found to be  $11.50 \pm 1.79$ ,  $13.27 \pm 2.98$ ,  $8.14 \pm 0.80$  and  $9.27 \pm 2.07$  in group A, group B, group Ca and group Cb respectively, showing statistically significant difference ( $p < 0.001$ ) between group Ca which recorded the lowest value compared to group B which recorded the highest value. Portal vein congestion index (P.CI) was found to be  $0.12 \pm 0.03$ ,  $0.15 \pm 0.04$ ,  $0.22 \pm 0.10$  and  $0.21 \pm 0.05$  in group A, group B, group Ca and group Cb respectively, showing statistically significant difference ( $p < 0.001$ ) between group A which recorded the lowest value compared to group Ca which recorded the

highest value. Portal vein thrombosis (PVT) not present in group A and group B, while PVT was present in 3 patients (50.0%) and 7 patients (20.59%) in group Ca and group Cb respectively, showing statistically significant difference ( $p < 0.001$ ) between group Ca which recorded the highest value compared to other groups. Direction of blood flow in portal vein was found to be normal in 35 patients (87.50%) in group A, 34 (85.0%) patients in group B, 3 patients (50.0%) in group Ca, and 24 patients (70.59%) in group Cb, showing no statistically significant difference between the studied groups (Table 6).

**Table (6): Comparison between Studied groups regarding trans-abdominal doppler ultra-sonographic findings of portal vein (PV)**

Parameters	Group A (n=40)		Group B (n=40)		Group Ca (n=6)		Group Cb (n=34)		P value
<b>Portal vein diameter (PVD) (mm)</b>	13.32±1.06		15.40±2.05		14.50±3.35		15.32±1.81		<0.001
Mean ±SD	10.00-		13.30-		10.00-		12.50-		
Range	14.50		25.00		18.50		20.00		
<b>Significance between groups</b>	p <sub>1</sub> <0.001*, p <sub>2</sub> =0.438, p <sub>3</sub> <0.001*, p <sub>4</sub> =0.664, p <sub>5</sub> =0.998, p <sub>6</sub> =0.727								
<b>Portal vein cross sectional area (cm<sup>2</sup>)</b>	1.40±0.21		1.89±0.59		1.73±0.74		1.87±0.45		<0.001
- Mean ±SD	0.79-1.65		1.39-4.91		0.79-2.69		1.23-3.14		
- Range									
<b>Significance between groups</b>	p <sub>1</sub> <0.001*, p <sub>2</sub> =0.028*, p <sub>3</sub> <0.001*, p <sub>4</sub> =0.554, p <sub>5</sub> =0.862, p <sub>6</sub> =0.621								
<b>Mean portal vein flow velocity (M.PVV) (cm/sec)</b>	11.50±1.79		13.27±2.98		8.14±0.80		9.27±2.07		<0.001
- Mean ±SD	9.42-16.63		9.06-19.70		7.18-9.00		6.33-13.67		
- Range									
<b>Significance between groups</b>	p <sub>1</sub> =0.004*, p <sub>2</sub> =0.006*, p <sub>3</sub> <0.001*, p <sub>4</sub> <0.001*, p <sub>5</sub> <0.001*, p <sub>6</sub> =0.687								
<b>Portal vein congestion index (P.CI) (cm/sec)</b>	0.12±0.03		0.15±0.04		0.22±0.10		0.21±0.05		<0.001
Mean ±SD	0.07-0.16		0.08-0.27		0.11-0.34		0.09-0.31		
Range									
<b>Significance between groups</b>	p <sub>1</sub> =0.020*, p <sub>2</sub> <0.005*, p <sub>3</sub> <0.001*, p <sub>4</sub> =0.099*, p <sub>5</sub> <0.001*, p <sub>6</sub> =0.422								
	No.	%	No.	%	No.	%	No.	%	P value
<b>Portal vein thrombosis (PVT)</b>									<0.001
No	40	100.0	40	100.0	3	50.00	27	79.41	
Yes	0	0.00	0	0.00	3	50.00	7	20.59	
<b>Total</b>	40	100.0	40	100.0	6	100.0	34	100.0	
<b>Significance between groups</b>	p <sub>1</sub> , <sup>FE</sup> p <sub>2</sub> =0.001*, <sup>FE</sup> p <sub>3</sub> =0.003*, <sup>FE</sup> p <sub>4</sub> =0.001*, <sup>FE</sup> p <sub>5</sub> =0.003*, <sup>FE</sup> p <sub>6</sub> =0.153								
<b>Direction of flow in PV</b>									0.063
- Abnormal	5	12.50	6	15.00	3	50.00	10	29.41	
- Normal	35	87.50	34	85.00	3	50.00	24	70.59	
- <b>Total</b>	40	100.0	40	100.0	6	100.0	34	100.0	

X2: Chi square. PV: portal vein. SD: standard deviation.

p1: p value for comparing between Group A and Group B.

p2: p value for comparing between Group A and Group CA.

p3: p value for comparing between Group A and Group CB.

p4: p value for comparing between Group B and Group CA.

p5: p value for comparing between Group B and Group CB.

p6: p value for comparing between Group CA and Group CB.

Regarding collaterals, it was found to be present in only 5 patients (12.50%) in group A, 9 patients (22.50%) in group B, 5 patients (83.33%) in group Ca and 29 patients (85.3%) in group Cb, showing statistically significant difference ( $P < 0.001$ ) between group A which recorded the lowest value compared to group Cb which recorded the highest

value. Hepatic vein (HV) was found to be attenuated in 9 patients (22.50%) in group A, 16 patients (40%) in group B, 3 patients (50.0%) in group Ca and 16 patients (47.06%) in group Cb, showing no statistically significant difference of attenuated hepatic vein ( $p < 0.103$ ) between the studied groups (Table 7).

**Table (7): Comparison between Studied groups regarding hepatic vein (HV) and collaterals**

Groups Parameters	Group A (n=40)		Group B (n=40)		Group Ca (n=6)		Group Cb (n=34)		P value
	No.	%	No.	%	No.	%	No.	%	
<b>Hepatic vein (HV)</b>									0.128
Normal	31	77.50	24	60.00	3	50.00	18	52.94	
Attenuate	9	22.50	16	40.00	3	3	16	47.06	
<b>Total</b>	40	100.00	40	100.00	6	100.00	34	100.00	
<b>Collaterals</b>									
No	35	87.5	31	77.50	1	16.67	5	14.7	<0.001
Yes	5	12.50	9	22.50	5	83.33	29	85.3	
<b>Total</b>	40	100.00	40	100.00	6	100.00	34	100.00	
<b>Significance between groups</b>	$p_1=0.239, p_2=0.001^*, p_3<0.001^*, p_4=0.007^*, p_5<0.001^*, p_6=1.000^*$								

$\chi^2$ : Chi square.

$p_1$ : p value for comparing between Group A and Group B.

$p_2$ : p value for comparing between Group A and Group CA.

$p_3$ : p value for comparing between Group A and Group CB.

$p_4$ : p value for comparing between Group B and Group CA.

$p_5$ : p value for comparing between Group B and Group CB.

$p_6$ : p value for comparing between Group CA and Group CB.

## DISCUSSION

In our study, there were no statistically significant differences between the studied groups regarding hemoglobin level, platelet count and INR. These results came in agreement with *Sharma et al. (2017)* that found that there was no significant difference between esophageal and gastric varices regarding platelets. Also, agreed with the study conducted by *Rezayat et al. (2014)* who evaluated changes of doppler indices in gastric

varices patients with and without gastroesophageal varices. On the other hands, *Ali et al. (2015)* found that there was a significant decrease in the mean values of platelet count/ spleen diameter ratio in cirrhotic patients with gastric varices in comparison to other patients without gastric varices.

Our study showed statistically significant difference of the mean values of the splenic size in group Cb which recorded the highest value compared to

group A which recorded the lowest value. This agreed with the study of *Ozdil et al. (2016)*. On the other hand, *Mahassadi et al. (2012)* found a lower diagnostic accuracy of splenic size (in Ivorian cirrhotic patients) suggesting that splenomegaly in the African context might not be useful as predictor of gastroesophageal varices.

Ascites in our study showed statistically significant difference where it was marked in group Cb which recorded the highest value compared to other groups. This finding was in concordance with the results of *Ramzy et al. (2015)* and *Al-Azhary et al. (2018)* who found that ascites in the group I (patients with gastroesophageal varices) was more than group II (patients without gastric varices).

In the current study, splenic vein diameter, splenic vein cross sectional area, and splenic congestion index significantly increased among group Ca and group Cb than group A and group B, and this came in concordance with the study of *Esmat et al. (2012)* who found a statistically significant correlation between the presence and grade of gastroesophageal varices with the splenic diameter, and also was in concordance with results of *Rezayat et al. (2014)* who found that in half of patients with portal hypertension the splenic vein diameter increases to more than 10 mm. The mean diameter of splenic vein in patients without GVs was 9.4 and was 10.8 in those with GVs, but the difference was not significant.

In our study, portal vein diameter (PVD) significantly increased among group Cb, portal vein congestion index was significantly increased in group Ca.

The mean portal vein flow velocity (M.PVV) significantly decreased among group Ca and the cross sectional area of portal vein was significantly increased among group B, This results agreed with the study done by *Mostafa et al. (2013)* who found that the ultra-sonographic parameters showed a significant increase in the splenic diameter and PVD between control group and studied subgroups. On the other hand, the study conducted by *Rezayat et al. (2014)* reported nosignificant difference between those patients with and without gastroesophageal varices for portal vein diameter. In the study of *Chouhan et al. (2015)*, it was found that there no statistically significant differences in portal vein velocity, congestion index and liver vascular index among the three studied groups.

Regarding portal vein thrombosis (PVT), our study revealed that group Ca showed statistically significant difference compared to other groups, and this came in concordance with *Sharma et al. (2017)* who reported that, with portal vein occlusion, both esophageal and gastric varices may develop in the absence of cirrhosis and in this setting varices were most commonly isolated gastric varices rather than gastroesophageal.

Regarding direction of flow in portal vein, our study showed no statistically significant difference between the four groups. This agreed with the study conducted by *Rezayat et al. (2014)*.

*Heikal (2020)* demonstrated that, cirrhosis is combined with increased intrahepatic resistance which increases pressure in the portal vein (PV) which enhances the opening up of various

collateral pathways. These hemodynamic events are responsible for the progressive fall in the portal venous blood flow velocity with increasing severity of the portal hypertension.

In our study, presence of collaterals showed statistically significant difference between group Cb which recorded the highest value compared to group A which recorded the lowest value. This agreed with *El-Assaly et al. (2020)* who reported that, the commonest type of collaterals draining into superior vena cava is the peri-gastric type, and detected esophageal and paraesophageal collaterals in 70% of cases and peri-gastric in 76.7% of cases.

## CONCLUSION

Doppler ultrasound can be an easy, cheap and safe alternative, while platelet count has no any significance in predicting of gastric varices.

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## تقييم عدد الصفائح الدموية والأشعة التلفزيونية بالدوبلر على أوردة الكبد والطحال للتنبؤ بوجود دوالي المعدة فى مرضى التلىف الكبدى

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**خلفية البحث:** تعد دوالي المعدة والمرئ من المضاعفات الرئيسية لتليف الكبد، وقد تؤدي إلى مضاعفات خطيرة تهدد الحياة، لذا يعتبر التنبؤ بوجودها أمراً هاماً، وحيث ان المنظار العلوي للمعدة والمرئ هو وسيلة تداخلية مكلفة وتحمل العديد من المخاطر مثل العدوى والنزف والثقب، لذا وجب البحث عن وسائل غير تداخلية للتنبؤ بوجود دوالي المعدة.

**الهدف من البحث:** تقييم عدد الصفائح الدموية والموجات فوق الصوتية بالدوبلر على أوردة الكبد والطحال كمتنبئات غير تداخلية بوجود دوالي المعدة في المرضى المصريين الذين يعانون من التليف الكبدى مع عدم وجود تاريخ سابق من التدخل بالمنظار أو الجراحة لعلاج إرتفاع ضغط الدم في الوريد البابي.

**المرضى وطريقة البحث:** أجريت هذه الدراسة في مستشفيات جامعة الأزهر بأقسام الكبد والجهاز الهضمي والأمراض المعديّة بالقاهرة في الفترة من سبتمبر 2018 حتى ديسمبر 2019 حيث تمت الدراسة على 120 مريضاً يعانون من التليف الكبدى دون وجود تاريخ سابق من التدخل بالمنظار أو الجراحة لعلاج إرتفاع ضغط الدم فى الوريد البابي وتم تقسيم المرضى إلى ثلاث مجموعات على النحو التالي: المجموعة (أ) (A): شملت أربعين مريضاً بالتليف الكبدى دون دوالي، والمجموعة (ب) (B): شملت أربعين مريضاً بالتليف الكبدى مع دوالي المريء فقط (OVs)، والمجموعة (ج) (C): شملت أربعين مريضاً بالتليف الكبدى مع دوالي المعدة مقسمة إلى مجموعتين فرعيتين هما المجموعة: Ca شملت ستة

مرض بالتليف الكبدي مع دوالي المعدة فقط، والمجموعة Cb: شملت أربعة وثلاثون مريضاً بالتليف الكبدي مع دوالي المعدة والمرئ معاً.

**نتائج البحث:** سجلت المجموعة A أدنى قيمة لحجم الطحال مقارنة بالمجموعة Cb التي سجلت أعلى قيمة ( $P < 0.001$ )، كما سجلت أدنى قيمة لمساحة المقطع العرضي للوريد البابي ( $p < 0.001$ ) مقارنة بالمجموعة B التي سجلت أعلى قيمة، كما سجلت المجموعة Cb أعلى قيمة لحجم الطحال ( $P < 0.001$ )، والاستسقاء ( $P = 0.006$ )، وقطر الوريد البابي ( $p < 0.001$ )، ووجود الضمانات أو الاوردة الجانبية ( $p < 0.001$ ) مقارنة بالمجموعات الأخرى في حين أن حجم الكبد وسماك المحيط للثلاثي البابي داخل الكبد وعدد الصفائح الدموية لا يظهر أي فرق يعتد به إحصائياً بين المجموعات الأربع ( $P > 0.05$ ). كما سجلت المجموعة Ca أدنى قيمة لسرعة تدفق الدم بالوريد البابي (MPVV) مقارنة بالمجموعة B التي سجلت أعلى قيمة لها وكذلك أدنى قيمة لسرعة تدفق الدم بالوريد الطحالي ( $P = 0.026$ ) (M.SVV) مقارنة بالمجموعة A اللتي سجلت أعلى قيمة، كما أن المجموعة Ca سجلت أعلى قيمة لمؤشر احتقان الوريد البابي (P.CI) ( $P < 0.001$ ) ووجود جلطة بالوريد البابي (PVT) ( $P < 0.001$ ) وقطر الوريد الطحالي ( $P < 0.001$ ) (SVD) ومساحة المقطع العرضي للوريد الطحالي ( $P < 0.001$ ) ومعامل احتقان الوريد الطحالي (S.CI) ( $P < 0.001$ ) والاتجاه غير الطبيعي لتدفق الدم بالوريد الطحالي ( $P = 0.019$ ) مقارنة بالمجموعات الأخرى.

**الاستنتاج:** الدوبلر بالموجات فوق الصوتية يمكن أن يكون بديلاً سهلاً ورخيصاً وأمناً للتنبؤ بوجود دوالي المعدة، كما وجد أن عدد الصفائح الدموية ليس له أي أهمية في التنبؤ بدوالي المعدة.

**الكلمات الدالة:** التليف الكبدي، الصفائح الدموية، الموجات فوق الصوتية، الدوبلر، الوريد الكبدي، الوريد الطحالي، دوالي المعدة.