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RESEARCH ARTICLE

Liver Stiffness measurement and other non invasive tools for Prediction of Oesophageal and Gastric Varices.

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Abstract

Background: Development of oesophagogastric varices is the most common sequalae that may occur in patients with liver cirrhosis. Non invasiveness has become a major goal in hepatology in the latter years. Several serum markers and imaging methods have been demonstrated to correlate well with fibrosis stage and degree of portal hypertension. So, these methods have been tried for the non invasive prediction of oesophageal and or gastric varices

Objectives: To assess the accuracy of liver stiffness measurement , some laboratory indices and Doppler parameters in prediction of presence esophageal and/or gastric varices.

Subjects and methods: This study was performed on 73 compensated cirrhotic patients at Zagazig University hospital from June 2013 to May 2015. Diagnosis of liver cirrhosis was based on history, clinical, laboratory and imaging data. Patients were divided into two groups; group A, patients with no varices and group B those with oesophageal varices. Patients with varices were subdivided into those with small varices and those with large varices. Also patients with gastric varices were recorded .

Results: The most accurate parameters for prediction of presence of OV according to our study, were congestive index, TE and Lok score. The most accurate parameters for prediction of the presence of large OV in this study were portal blood flow, C.I. and Lok score .The most accurate parameters for prediction of the possibility of presence of gastric varices were AST/platelets ratio index, Splenic artery flow volume and Lok score

Conclusion: TE is a good positive test for screening purpose of OV (sensitivity 93.3%), yet less good positive for OV size differentiation and possibility of presence of gastric varices (sensitivity 88.2% and 66.7% respectively). TE is not a good negative test to exclude patients from endoscopic screening for presence of OV, large OV and possibility of gastric varices (specificity 76.7, 69.2 and 79.1%) respectively.

INTRODUCTION

The development of portal hypertension, a common consequence of chronic liver diseases, leads to the formation of esophageal and gastric varices responsible for variceal bleeding which is associated with a high mortality rate[1].

The first crucial step in prevention of variceal bleeding is to identify the patients at risk of bleeding in order to select them for prophylactic treatment. Current guidelines recommend that all patients should undergo endoscopic

screening for varices at the time when cirrhosis is diagnosed. After screening endoscopy, patients with medium or large varices should be treated to prevent bleeding while all other patients should undergo periodic surveillance endoscopy[2].

Screening all cirrhotic patients with upper GI endoscopy to detect the presence of varices implies a number of unnecessary endoscopies which increase the work load of endoscopy units. In addition, compliance with endoscopic screening recommendations may be limited, since they require repeated procedures that are perceived as unpleasant, require conscious sedation in most cases, may lead to decreased work productivity and have a small but not insignificant risk of complications. These factors may decrease patient compliance leading to a decrease in the effectiveness of the screening programs[3].

As a consequence, several non-invasive tools have been evaluated in the search of prediction of oesophageogastric varices, such as laboratory parameters and Doppler quantitative studies[4].

Transient Elastography is a novel, rapid, non-invasive, and reproducible method developed for assessing liver stiffness as an indicator of liver fibrosis and hence portal hypertension[5].

Kazemi et al. [6] suggested that Transient Elastography may predict the presence of oesophageogastric varices in patients with liver cirrhosis and could, therefore, be used to select those patients to be referred for upper gastrointestinal endoscopy.

Patient and methods

A cross sectional study was performed on 73 compensated cirrhotic patients, selected based on systematic random sample technique, who attended the Gastroenterology and hepatology outpatient clinic, Advanced Center for Liver Diseases and Gastrointestinal endoscopy unit at Internal Medicine Department, Zagazig University hospital from June 2013 to May 2015. Diagnosis of liver cirrhosis was based on history, clinical, laboratory and imaging data.

All patients fulfilled the following criteria:

Inclusion criteria:

- Adult patient (≥18 years old).
- Radiologically proven cirrhosis.
- Compensated cirrhosis.
- Average weight (Body Mass Index ≤ 28%)

Exclusion criteria

- Previous or current decompensation (patients with ascites even detected by ultrasonography examination only)
- Previous or current gastrointestinal tract bleeding.
- Obese patients (BMI > 28).
- Patients on treatment with Beta- adrenergic receptor blockers.
- Patients with portal vein thrombosis.
- Patients with hepatocellular carcinoma.
- Patients with history of previous surgery to the liver and/ or the spleen.

Patients were classified into two groups:

- Group I: included patients with liver cirrhosis and without esophageal varices.
- Group II A: included patients with liver cirrhosis and with small esophageal varices (< Grade II).
- Group II B: included patients with liver cirrhosis and with large esophageal varices (≥ Grade II).
- Patients with gastric varices were recorded

After getting an informed verbal consent from all patients, they were subjected to the following:

1- Detailed medical history and thorough clinical examination with special emphasis on stigmata of liver cell failure and/or signs of portal hypertension

2- Laboratory investigations including:

- Complete blood count (CBC)
- Serum alanine aminotransferase (ALT), serum aspartate aminotransferase (AST)
- **Coagulation profile:** prothrombin time (PT), partial thromboplastin time (PTT), INR (International normalized ratio) and prothrombin concentration (PC)

3- Abdominal ultrasonography:

Real time scanning was done to all patients using device **PHILIPS *IU22 X-MATRIX*** (USA), to detect signs of liver cirrhosis, signs of portal hypertension, exclude ascites and hepatic focal lesion and Measuring bipolar Spleen diameter**.**

Notably, PHILIPS *IU22 X-MATRIX* (USA) has the advantage of containing ultrasound, doppler and transient elastography techniques.

4- Doppler ultrasonography:

Abdominal Doppler ultrasonography was done by the same device to assess the portal and splenic haemodynamics determining and calculating the following parameters [7]:

a) Portal blood flow volume (**PVF**)
b) Congestion index of the portal vein (**CI**)
c) Splenic artery flow volume (ml/min).
d) Superior mesenteric artery flow volume (ml/min).
e) Collateral blood flow calculated by difference between portal blood inflow (the sum of superior mesenteric artery and splenic artery blood flow volumes) and portal venous blood flow volume.

All measurements are performed after an overnight fast.

5- Upper Gastrointestinal Endoscopy:

It was done in internal medicine gastrointestinal endoscopy unit by the same endoscopist to avoid interobserver error using **Olympus GIF 160-Q165 (EXERA II)**

6- Measurement of liver stiffness using Transient Elastography:

T.E. was done using (**PHILIPS *IU22 X-MATRIX***) by a single operator who was blind to the results of endoscopy.

Relation between T.E. in Kilo Pascal (KPa) and stages of fibrosis (Metavir score) using (**PHILIPS *IU22 X-MATRIX***)
is determined as follow:

- Metavir F0-F1: 3-7 KPa Normal
- Metavir F2: 8-11 KPa Mild fibrosis
- Metavir F3: 12-21 KPa Moderate fibrosis
- Metavir F4: 22+ KPa Severe fibrosis

7- Calculation of serum liver fibrosis scores

- **Platelet/spleen size ratio**:
- **APRI** (AST to platelets ratio index)

- **AST/ALT ratio**
- **Lok Score**

.

Results

The most accurate parameters for prediction of presence of OV according to our study, were congestive index, TE and Lok score. The most accurate parameters for prediction of the presence of large OV in this study were Portal blood flow, CI and Lok score .The most accurate parameters for the prediction of the possibility of presence of gastric varices were AST/platelets ratio index, Splenic artery flow volume and Lok score .TE is a good positive test for screening purpose of OV (sensitivity 93.3%), yet less good positive for OV size differentiation and possibility of presence of gastric varices (sensitivity 88.2% and 66.7% respectively). TE is not a good negative test to exclude patients from endoscopic screening for presence of OV, Large OV and possibility of Gastric Varices (specificity 76.7, 69.2 and 79.1%) respectively.(tables of results are shown below.

Discussion

Sociodemographic characteristics of study participants:

In our study, The large majority of the cases with and without esophageal varices were males (76.7% and 84.6%) respectively. Whereas 61.5% of the studied cases with no varices lived in urban areas, 56.7% of cases with varices come from rural areas (with no significant relation between both studied groups regarding either sex or residence). (69.2% and 82.4%) of our studied cases with small varices(B1) and with large varices (B2) were males respectively and come from rural areas (61.5% and 52.9%) respectively but also no significant relationship between both groups regarding sex and residence (table 1 and 5).

Our cases with varices tend to be significantly older in age (53.68± 7.34) than cases without esophageal varices (48.3±7.59) ($p<0.05$) (table 1). Also, cases with large varices were significantly older in age than those with small varices (57.15±6.08) ($p<0.005$) (table1 and 5).

Transient Elastography readings in study participants:

Regarding Transient Elastography readings of the studied groups, they were significantly higher among cases with oesophageal varices (39.990±5.43) and cases with large OV (41.09 ±7.24) ($p<0.05$) (table 2 and 6)

Our study agreed with **Esmat et al.** [8] who showed that the values of liver stiffness measurements increase with the grades of oesophageal varices with highly significant relationship between cases with and without OV and between different sizes of OV.

Also, in agreement with our study, **Medhat et al.** [9] found that there was statistically significant difference between patients with small esophageal varices compared to patients with large esophageal varices as regards the results of transient elastography

Performance of Transient Elastography in prediction of varices

Our study showed that Transient Elastography -using **(x-matrix iu-22)**- is a good predictor for presence of OV at cutoff value ≥ 23 with AUC 0.68, sensitivity 93.3%, specificity 76.7%, PPV 94.9%, NPV 71.4% and overall accuracy 90.4% (table 14).

Also, we found that best cutoff value of TE in differentiation of esophageal varices was ≥36.2 with AUROC 0.58, sensitivity 88.2%, specificity 69.2%, PPV 78.9%, NPV 81.8%and overall accuracy 80% (table 16).

Another study suggested that, for a cutoff value (18.2 kPa), sensitivity was 82%, specificity was 73%, PPV was 89%, NPV was 49% and accuracy was 80% in prediction of presence of OV. Regarding prediction of large varices, for a cutoff value (22.4 kPa), sensitivity was 84%, specificity was 72%, PPV was 84%, NPV was 72% and accuracy was 70% [9]

Castera and colleagues [10] found that for a cutoff of 21.5 kPa predicted the presence of OV with a sensitivity of 76%, specificity 78%, PPV 68%, and NPV 84% and correctly classified 73% of patients. At a cutoff of 30.5 kPa, the presence of large OV was predicted with a sensitivity 77%, specificity 85%, PPV 56%, and NPV 94%, and correctly classified 79% of patients.

Stefanescu et al. [11] noticed that when using cutoff value (19 kPa), it was possible to predict esophageal varices with sensitivity 84%, specificity 32.3%, PPV 72.4% and NPV 48.9%. When using cutoff value (38 kPa), it was possible to predict LEV (≥ grade 2) with an acceptable sensitivity and specificity (76% and 80% respectively), but the positive predictive value did not exceed 54%.

All the previous studies are in concordance with our findings where prediction of presence of OV or differentiation of size of OV mainly occur best at cutoff values pointed to F4; The difference between our results and other studies' results can be explained by different devices used in studies. the device used in our study is (**PHILIPS IU22 X-MATRIX**),while device used in all other studies was **Fibroscan**, both devices use the same technique but with different cutoff readings for staging, however cutoff readings of both devices belong to the stage of F4. F4 is diagnosed by (**PHILIPS IU22 X-MATRIX**) at cutoff value ≥22 kPa, while reading ≥17 kPa by **Fibroscan** diagnoses F4.

AST/ALT ratio in prediction of varices.

The best cutoff value of AST/ALT ratio in diagnosis of esophageal varices was ≥0.85 with sensitivity 83.3%, specificity76.9%, PPV 83.3%, NPV 76.9%, and overall accuracy 82.2% (table 13)

The best cutoff value of AST/ALT ratio in diagnosis of large esophageal varices was ≥0.99 with sensitivity 79.4%, specificity61.5%, PPV 71%, NPV 72.7%, and overall accuracy 71.7%(table 15)

In another study, using a different cut-off ≥1.0 demonstrated a sensitivity of 68%, specificity of 89%, PPV 77%, and NPV 83% for predicting the presence of oesophageal varices**.** For the prediction of large oesophageal varices, this gave a sensitivity 68%, specificity 77%, PPV 41%, and NPV 92%. Overall, the AST/ALT ratio correctly classified 81% patients for the detection of varices and 76% of those with large varices. (12)

These studies (including ours) identified different cutoffs for the AST/ALT ratio. This can be explained by that the exact mechanism of AST/ALT ratio alteration in progression of liver disease is unclear and its correlation with the degree of fibrosis, presence of cirrhosis and its complications is controversial **(13)**

AST/Platelets ratio index(APRI) in prediction of varices

In the current study, The best cutoff value of APRI in diagnosis of esophageal varices was ≥0.86 with sensitivity 86.7%, specificity 84.6%, PPV 82.5%, NPV 80 %, and overall accuracy 86.3%. ($p<0.05$)(table 13)

The best cutoff value of APRI in diagnosis of large esophageal varices was ≥1.07 with sensitivity 82.4%, specificity 76.9%, PPV 82.4%, NPV 76.9%, and overall accuracy 80%.(table 15)

In another study, the best cutoff value for prediction of presence of varices was (≥1.1) with sensitivity 76%, specificity 73%, PPV 90.5%, NPV 47% and accuracy 71%. also for the prediction of LEV, the best cutoff value was at (≥2.2) and showed sensitivity 87%, specificity 44%, PPV 73%, NPV 66% and accuracy 67% [9].

Different cutoff values by different accuracies had been explained by different and variable mechanisms for thrombocytopenia including portal hypertension with congestive splenomegaly, decreased thrombopoietin levels, presence of antithrombocytic antibodies and thrombocyte associated immunoglobulin, which can be found in the sera of patients with liver diseases.

Also, AST values may be variable among different studies due to different ranges i.e. some laboratories identify the highest normal value of AST to be 12 unit/l, others identify 38 or 40 unit/l as the highest normal value

Platelet count/spleen size in prediction of varices

The platelet count / spleen size ratio was a predictive index for the presence of oesophageal varices with the best cutoff value ≥ 366, sensitivity 90%, specificity 81.7%, PPV 95.5, NPV 63.3% and an overall accuracy of 89% (table 13).

It was also a predictive index for the diagnosis of LEV at cutoff value ≥ 312 with sensitivity 92.3%, specificity 73.5%, PPV 81.6%, NPV 86.4% an overall accuracy 83.3% (table 15).

Nearly the same result, but with different cutoff ,was concluded by **Esmat and Rashid** [14], in a study aiming to evaluate prospectively the platelet count / spleen size ratio as a non invasive predictor of OV in post hepatitis C liver cirrhosis in Egypt, they found that at a cut off 136.58, platelet count / spleen size ratio highly suspected the presence of OV with high accuracy 94%.

The difference between our results and other results may be attributed to variable causes of thrombocytopenia which includes productive, consumptive or distributional mechanisms. Splenic sequestration or antibody-mediated destruction of platelets have been believed to be the cause of thrombocytopenia in patients with cirrhosis. However, recent studies have implicated reduced hepatic production of liver-derived thrombocytopoietic growth factor (thrombopoietin) or its rapid degradation and suppressive effects of viruses on bone marrow [15].

So the degree of thrombocytopenia may not be proportional to the degree of portal hypertension and subsequently the spleen diameter may be variable in the presence of nearly equal platelet count in variable number of patients

Portal blood flow volume in prediction of varices:

It was shown that the mean portal vein flow was a predictive index for the presence of OV with cutoff value ≥ 284.5 ml/min with sensitivity 73.3%, specificity 84.6%, PPV 95.6%, NPV 70.4% and overall accuracy 75.3%.(table 13)

We also found that the mean portal vein flow was a predictive index for the presence of LEV with cutoff value≥247.5 ml/min, with sensitivity 73.5%, specificity 73.1%, PPV 83.3%, NPV 67.9%, and overall accuracy 90% (table 15).

In another study on cirrhotic patients, it was found that at cutoff value 0.430 l/min sensitivity was 85%, specificity 90%, NPV 89%, PPV 47% with overall accuracy 85.7%. Also, there was a highly significant negative correlation between portal vein flow and grading of varices[7].

Another study also found that portal vein flow was clearly lower in patients with cirrhosis complicated with varices[16].

Reduction in flow volume of portal vein in patients with liver cirrhosis is due to the presence of irreversible intrahepatic resistance to flow[17].

Devries et al.[18] reported that reduction of portal blood flow volume is probably only one sign and alone is not suitable for reflecting the complx blood flow regulatory and compensatory mechanisms in chronic liver disease. This would explain different values and even different findings in similar studies.

Splenic artery flow volume in prediction of varices:

We found that splenic arterial blood flow can be used for predicting the presence of OV at a cutoff ≥ 321ml/min with sensitivity of 68.3% specificity 61.5% PPV 89.1% NPV 69.6% and an overall accuracy 71.2% (table 13).

It was also found that Splenic arterial blood flow can also predict the presence of LOV at cutoff value ≥ 382ml/min with sensitivity of 79.4% specificity 69.2% PPV 77.1% NPV 72%, , overall accuracy 75% (table 15).

CI in prediction of varices

Congestive index (CI) was a predictive index of the presence of OV with cutoff value ≥0.086(cm x sec), sensitivity 96.7%, specificity 76.9%, PPV 95%, NPV 83.3% and overall accuracy 93.1% (table 14).

We also found that CI was an accurate index for predicting the presence of LOV with a cutoff value ≥0.118with a sensitivity of 88.2% specificity 92.3% PPV 93.8% NPV 85.7% and overall accuracy 90%(table 16) .

Plestina et al.[19] proved that at a cut-off value of 0.154 cm×sec, the CI has a sensitivity of 70% and specificity of 64.9% for prediction of the presence of the large OV with risk of bleeding from OV (OV grade III and presence of red cherry spots).

Colli et al.[20] demonstrated that a cut off value of CI ≥ 0.12 cm × sec was present in 50% of patients with OV and 30% of patients without OV. At this value (≥ 0.12cm × sec), CI with a specificity of 60% and sensitvity of 60%, does not predict accurately PHT or presence of OV.

The differences between our results and results in other studies aregarding Doppler parameters may be attributed to interobserver variability as Doppler studies are operator dependent.

Lok score in prediction of varices

In our study, The best cutoff value of Lok score in prediction of esophageal varices was ≥0.66 with sensitivity 90%, specificity 84.6%, PPV 96.4%, NPV 67.4%, and overall accuracy 89%(table 14).

We also found that, the best cutoff value of Lok score in prediction of large esophageal varices was ≥0.75 with sensitivity 94.1%, specificity 84.6%, PPV 88.9%, NPV 91.7%,and overall accuracy 90%(table 16).

This agreed with **Medhat et al.**[9],but with slightly different cutoff and different accuracy, in which best cutoff value was (≥0.63) for prediction of presence of varices with sensitivity 60%, specificity 80%, PPV 78%, NPV 42% and accuracy 79%. Also, the best cutoff value for prediction of large varices was (≥0.7). It showed sensitivity 87.5%, specificity 55.5%, PPV 77%, NPV 67% and accuracy 76%.

Gastric varices

Socio-deographic characters

66.7% and 79.1% of the studied cases with and without gastric varices were males respectively. About half of studied cases with gastric varices lived in rural area (with no significant relation between both studied groups in either sex or residence). Cases with gastric varices tend to be older (61.33± 9.83) than cases without gastric varices (51.96±6.97) with high significant relationship between both studied groups regarding age ($p<0.005$) (table 9)

Prediction of gastric varices:

To the best of our knowledge, it is the first study done to evaluate the role of the following mentioned parameters in prediction for the possibility of presence of gastric varices.

Transient Elastography in prediction of gastric varices:

The best cutoff value of TE in diagnosis of gastric varices was ≥35.5 with AUROC 0.59, sensitivity 66.7%, specificity 79.1%, PPV 70.2%, NPV 87.5% and overall accuracy 78.1% (table 17).

This cutoff value was higher than the cutoff value we recorded for prediction of Oesophageal varices (23) and less than that for predicting the presence of LOV (36.2)

AST/Platelet ratio index in prediction of gastric varices:

The best cutoff value of APRI, according to our findings, in diagnosis of gastric varices was ≥ 0.86 with AUROC 0.72, sensitivity 86.7%, specificity 84.6%, PPV 82.5%, NPV 80 % and overall accuracy 96%(table 17)

This cutoff value was higher than the cutoff value we recorded for prediction of Oesophageal varices 0.85 while this cutoff was lower than that used for differentiation of the size of OV 0.99

Splenic arterial blood flow in prediction of gastric varices:

We found that splenic arterial blood flow was an accurate index for the diagnosing the presence of gastric varices at cutoff value ≥ 442. At this cutoff value. sensitivity was 83.3%, specificity was 91% with PPV 65.4% and NPV 98% and overall accuracy 90.4% (table 17)

This cutoff value was higher than the cutoff value we recorded for prediction of Oesophageal varices 321 and that for differentiation of the size of OV 382.

Lok score in prediction of gastric varices

We found that the best cutoff value of Lok score in prediction of gastric varices was ≥ 1.3 with AUROC 0.16, sensitivity 66.7%, specificity 100%, PPV 100%, NPV 97.1% and overall accuracy 97.3(table 17).

This cutoff value was higher than the cutoff value we recorded for prediction of Oesophageal varices 0.66 and that for differentiation of the size of OV 0.75.

Table (1): Socio-demographic characters of the two studied groups; patients with and without varices

Variable		Group A (no varices) (N=13)		Group B (with varices) (N=60)		χ^2	P
		N	%	N	%		
Sex	**Male**	11	84.6	46	76.7	0.39	0.53 NS
	Female	2	15.4	14	23.3		
Residence	**Rural**	5	38.5	34	56.7	1.42	0.22 N.S
	Urban	8	61.5	26	43.3		
Age: Mean ± SD Range		48.30 ± 7.59 37 – 57		53.68 ± 7.34 40 – 73		**T**	**P**
						2.38	**0.02***

Table (2): TE of the two studied groups; patients with and without varices

Variable	Group A (no varices) (N=13)	Group B (with varices) (N=60)	T	P
TE: Mean ± SD	35.98 ± 8.21	39.99 ± 5.43	**2.19**	**0.03***

Table (3): Differences in laboratory indices between the two studied groups:

Variable	Group A (no varices) (N=13)	Group B (with varices) (N=60)	MW	P
AST/ALT ratio: Mean ± SD	1.13 ± 0.43	1.28 ± 0.40	**226**	**0.04***
AST/Platelets ratio: Mean ± SD	1.3 ± 0.53	2.17 ± 1.28	**114**	**0.01***
Platelets/spleen Mean ± SD	497.38 ± 234.22	77.38 ± 134.55	**111**	**<0.001****
Lok score: Mean ± SD	0.47 ± 0.28	0.63 ± 0.41	**218**	**0.01***

Table (4): Differences in heamodynamic indices between the two studied groups;patients with and without varices:

Variable	Group A (no varices) (N=13)	Group B (with varices) (N=60)	Test	P
Portal blood flow:(cc/min) Mean ± SD	440.95 ± 246.67	395.92 ± 150.99	**MW 231**	**0.01***
Congestive index: Mean ± SD	0.11 ± 0.03	0.23 ± 0.15	**112**	**<0.001****

Splenic artery flow:(cc/min) Mean ± SD	493.28 ± 355.91	536.23 ± 349.21	**226**	**0.04***

Table (5): Differences in Socio-demographic characters between small varices and large varices groups:

Variable		**Group B1 (small varices) (N=26)**		**Group B2 (large varices) (N=34)**		**χ^2**	**P**
		N	**%**	**N**	**%**		
Sex	**Male**	18	69.2	28	82.4	1.42	0.23 NS
	Female	8	30.8	6	17.6		
Residence	**Rural**	16	61.5	18	52.9	0.44	0.25 N.S
	Urban	10	38.5	16	47.1		
Age: Mean ± SD Range		51.03 ± 7.17 40 – 64		57.15 ± 6.08 48 – 73		**T**	**P**
						3.49	**0.001****

Table (6): TE stages of small varices and large varices groups:

Variable	**Group B1 (small varices) (N=26)**	**Group B2 (large varices) (N=34)**	**T**	**P**
TE: Mean ± SD	37.91 ± 3.62	41.09 ± 7.24	**2.05**	**0.04***

Table (7): Differences in heamodynamic parameters between small varices and large varices groups:

Variable	**Group B1 (small varices) (N=26)**	**Group B2 (large varices) (N=34)**	**Test**	**P**
Portal blood flow:(cc/min) Mean ± SD	447.6 ± 213.1	432.3 ± 289.1	**MW 288**	**0.04***
Splenic artery flow:(cc/min) Mean ± SD	481 ± 343.74	578.47 ± 352.53	**230**	**0.04***
Congestive index: Mean ± SD	0.19 ± 0.07	0.29 ± 0.20	**252**	**0.03***

Table (8): Differences in laboratory indices between patients with small and large varices

Variable	**Group B1 (small varices) (N=26)**	**Group B2 (large varices) (N=34)**	**MW**	**P**
AST/ALT ratio: Mean ± SD	1.27 ± 0.51	1.29 ± 0.30	396	0.49 N.S

AST/Platelets ratio: Mean ± SD	2.12 ± 1.50	2.21 ± 1.1	**220**	**0.001***
Platelets/spleen Mean ± SD	596.1 ± 247.23	421.93 ± 195.53	**304**	**0.04***
Lok score: Mean ± SD	0.42 ± 0.15	0.52 ± 0.36	**312**	**0.05***

Table (9): Differences in Socio-demographic characters between cases with gastric varices and cases without:

Variable		**(no gastric varices) (N=67)**		**(Gastric varices) (N=6)**		**χ^2**	**P**
		N	**%**	**N**	**%**		
Sex	**Male**	53	79.1	4	66.7	0.50	0.48 NS
	Female	14	20.9	2	33.3		
Residence	**Rural**	36	49.3	3	50	0.03	0.86 N.S
	Urban	31	50.7	3	50		
Age: Mean ± SD Range		51.96 ± 6.97 37 – 64		61.33 ± 9.83 48 – 73		**T** **3.05**	**P** **0.003****

Table (10): TE stages of cases with gastric varices and cases without:

Variable	**(no gastric varices) (N=67)**	**(Gastric varices) (N=6)**	**T**	**P**
TE: Mean ± SD	35.9 ± 3.47	39.99 ± 6.13	**2.58**	**0.02***

Table (11): Differences in heamodynamic parameters between cases with gastric varices and cases without:

Variable	**(no gastric varices) (N=67)**	**(Gastric varices) (N=6)**	**Test**	**P**
Portal blood flow:(cc/min) Mean ± SD	436.47 ± 236.9	393.33 ± 184.95	**MW** 194	0.88 NS
Splenic artery flow:(cc/min) Mean ± SD	524.4 ± 343.1	600 ± 425.3	**84**	**0.03***
Congsitive index: Mean ± SD	0.20 ± 0.14	0.32 ± 0.19	**114**	**0.03***

Table (12): Differences in laboratory indices between cases with gastric varices and cases without:

Variable	**(no gastric varices) (N=67)**	**(Gastric varices) (N=6)**	**Test**	**P**
AST/ALT ratio: Mean ± SD	1.18 ± 0.30	1.26 ± 0.42	T 0.46	0.65 N.S
AST/Platelets ratio: Mean ± SD	1.34 ± 1.44	2.08 ± 1.2	**MW 76**	**0.02***

Platelets/spleen Mean ± SD	883.25 ± 346.4	517.16 ± 211.5	**116**	**0.04***
Lok score: Mean ± SD	0.45 ± 0.16	0.94 ± 0.54	**68**	**0.008***

Table (13): Laboratory and haemodynamic parameters for prediction of OV:

	Cutoff	AUC	Sens	Spec	+PV	-PV	+LR	-LR	Accur	P
AST/platelet	0.86	0.72	86.7	84.5	82.5	80	5.63	0.16	86.3	0.01*
Platelet/spleen size	366	0.85	90	81.7	95.5	63.3	2.23	0.12	89	<0.001**
AST/ALT	0.85	0.68	83.3	76.9	83.3	76.9	3.6	0.22	82.2	0.04*
Portal blood flow	284.5	0.52	73.3	84.6	95.6	70.4	4.76	0.32	75.3	0.03*
Splenic artery blood flow	321	0.54	68.3	61.5	89.1	69.6	1.77	0.52	71.2	0.04*

Table (14): The most accurate parameters for prediction of presence of OV:

	Cutoff	AUC	Sens	Spec	+PV	-PV	+LR	-LR	Accur	P
T.E.	≥23	0.68	93.3	76.7	94.9	71.4	4.04	0.09	90.4	<0.001**
C.I.	0.086	0.86	96.7	76.9	95	83.3	4.19	0.04	93.1	<0.001**
LOK	0.66	0.85	90	84.6	96.4	64.7	5.84	0.12	89	<0.001**

Table (15):Laboratory and haemodynamic parameters for prediction of OV size:

	Cutoff	AUC	Sens	Spec	+PV	-PV	+LR	-LR	Accur	P
AST/platelet	1.07	0.53	82.4	76.9	82.4	76.9	3.57	0.23	80	0.04*
Platelet/spleen size	312	0.75	92.3	73.5	81.6	86.4	3.48	0.1	83.3	<0.001**
AST/ALT	0.99	0.58	79.4	61.5	71	72.7	2.06	0.33	71.7	0.03*
Portal blood flow	247.5	0.56	73.5	73.1	83.3	67.9	2.73	0.36	90	0.03*
Splenic artery blood flow	382	0.62	79.4	61.5	69.2	72	2.41	0.30	75	0.03*

Table (16): T.E. and The most accurate parameters for prediction of size of OV

	Cutoff	AUC	Sens	Spec	+PV	-PV	+LR	-LR	Accur	P
T.E.	≥36.2	0.58	88.2	69.2	78.9	81.8	2.86	0.17	80	0.04*
Portal blood flow	247.5	0.56	73.5	73.1	83.3	67.9	2.73	0.36	90	0.03*
C.I.	0.118	0.77	88.2	92.3	93.8	85.7	11.45	0.13	90	<0.001*
LOK	0.75	0.60	94.1	84.6	88.9	91.7	6.11	0.07	90	0.02

Table (17): T.E. and The most accurate parameters for prediction of presence of gastric varices.

	Cutoff	AUC	Sens	spec	+PV	-PV	+LR	-LR	Accur	P
T.E.	≥35.5	0.59	66.7	79.1	70.2	87.5	3.19	0.42	78.1	0.04*
AST/Platelet ratio index.	1.6	0.28	83.3	97	71.4	98.4	7.78	0.86	96	0.008*
Splenic artery blood flow	442	0.47	83.3	91	65.4	98	9.25	0.18	90.4	0.02*

LOK	1.3	0.16	66.7	100	100	97.1	0	0.33	97.3	0.008*

References

1. **Laurent Castera, Massimo Pinzani and Jaime Bosch (2012):**Non invasive evaluation of portal hypertension using transient Elastography. Journal of Hepatology;56: 696–703.
2. **Garcia-Tsao G, Friedman S, Iredale J, et al., (2010):** Now there are many (stages) where before there was one: in search of a pathophysiological classification of cirrhosis. Hepatology;51:1445–1449.
3. **Eisen GM, Eliakim R, Zaman A, et al., (2006):** The accuracy of PillCam ESO capsule endoscopy versus conventional upper endoscopy for the diagnosis of esophageal varices: a prospective three-center pilot study. Endoscopy;38:31-5.
4. **Bosch J, Abraldes J, Groszmann R et al., (2003):** Current management of portal hypertension.J. Hepatol.; 38:54–68.
5. **Ziol M, Handra-Luca A, Kettaneh A, Christidis C**, **et al**., **(2005):** Noninvasive assessment of liver fibrosis by measurement of stiffness in patients with chronic hepatitis C. Hepatology;(41):48–54.
6. **Kazemi, AdrienKettaneh, Gise`leN'kontchou et al., (2006):** Liver stiffness measurement selects patients with cirrhosis at risk of bearing large oesophagealvarices. Journal of Hepatology;45: 230–235.
7. **Samir M. Zamzam, Tarek M. Sobhi, , Ahmed M. Mahmoud et al., (2004):** Colour Doppler ultrasound versus upper GI endoscopy in diagnosis of oesophageal varices in children with chronic liver diseases.102-103
8. **Esmat G., Ramzy E., Hasab Allah M., Ismail S., AbdelHafiz S. (2014):** Non invasive prediction of oesophageal varices with FibroScan and Doppler U/S in HCV patients with cirrhosis; 6:15.
9. **Medhat E., Omran D., Albeshlawy M.,El-Askary A.(2013):** Non Invasive Assessment of Esophageal Varices in Cirrhotic Patients (6) 115:127.
10. **Castera L, Foucher J, Bernard PH et al., (2009*):*** Prevelance and factors associated with liver stiffness measurements failure and unreliable results using fibroscan: a 5 year experience in 13369 examinations. *J Hepatology*. 50:S52.
11. **Stefanescu H, Grigorescu M, Lupsor M et al., (2011):** Spleen stiffness measurement using Fibroscan for the non invasive assessment of oesophageal varices in liver cirrhosis patients**.** J gastroenterology and Hepatology, vol. 26, no. 1:164-170.
12. **Castera L, Bail BL, Roudot-Thoraval F et al., 2009:** Early detection in routine clinical practice of cirrhosis and oesophageal varices in chronic hepatitis C: comparison of Transient ***Elastography*** (FibroScan) with standard laboratory tests and non- invasive scores. J Hepatology vol. 50, no. 1:59-68.
13. ***Davern TG and Scharshmidt BF, 2002:*** Biochemical liver tests. In: Feldman M, Friedman LS, Sleisenger MH, eds. Sleisenger& Fordtran's gastrointestinal and liver disease: pathophysiology, diagnosis, management. 7th ed. Philadelphia: Saunders; 1227-38.
14. **Esmat S and Rashid L, (2011)*:*** a comparative study between three non invasive predictors of oesophageal varices in post hepatitis C virus liver cirrhosis in Egypt. *Acta Gatroenterol. Belg.74(4)497-502*
15. **Ezz Eldin HS, Elsayed EY and Ameen A (2010):** Cytopenia As A Predictor Of esophageal Varices In Patients With Liver Cirrhosis. Report and Opinion; 2(7):35-41. (ISSN: 1553- 9873).
16. **Devreis P.J, Hoekstra J.BI, De Hooge P. and Van Hallum J. (1994):** Portal venous flow: Follow up in patients with liver diseases and healthy subjects. Scand J. Gastroenterol. 29: 172-7.
17. **Schassman,A., Zuber,M., Livers,M., et al.,(1993):** Recurrent bleeding after variceal haemorrhage:Predictive value of portal venous Duplex sonography.A.J.R.160:41-47
18. **Tincani E, Cioni G, D'Alimonte P., et al. (1997):** Value of the measurement of portal flow velocity in the differential diagnosis of asymptomatic splenomegally. Clinical Radilogy 52:220-223.
19. **Plestina S, Pulanic R, Kralic M et al., (2005):** Color Doppler ultrasonography is reliable in assessing the risk of esophageal variceal bleeding in patients withe liver cirrhosis. Wien Klin. Wochenschr. 117: 711-717.
20. **Colli A, Fraquelli M, Pometta R et al., (2001):** Renovascular impedance and esophageal varices in patients with Child-Pugh Class A. Radiology. 219:712-715.