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# Non-Invasive Panel for Prediction of Large Esophageal Varices in Patients with HCV-Related Cirrhosis after DAAS Therapy

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**Abstract:- To study sonographic and laboratory parameters as diagnostic non-invasive Indices for prediction and screening of large varices in liver cirrhotic patients post hepatitis C virus after direct Actin antiviral drugs (DAAS).**

➢ ***Introduction:***

**All cirrhotic patients should be screened for esophageal varices (EV) via endoscopy, as recommended by the guidelines. However, repeated endoscopy is not well accepted by patients and is a costly procedure that places a heavy burden on the endoscopic unit. Therefore, noninvasive predictors of EVs and size discrimination for EVs are of particular importance.**

➢ ***Patients and methods:***

**A total of 150 post-C liver cirrhosis patients, 37 females (24.7%) and 113 males (75.3%). After dividing DAAS into three arms: arm 1 with Non-EV, arm 2grad1&2 EV (Small Vriceal arm), and arm 3 grade 3&4 EV (Large Variceal arm). medical history, physical examination, standard laboratory tests, abdominal ultrasound, and sonographic parameters such as portal vein velocity (PVV). Splenic Index (SI) Splenoportal Index (SPI), platelet count/spleen diameter ratio (PCSDR) and upper gastrointestinal endoscopy were performed for all participants.**

➢ ***Results:***

**The Noninvasive sonographic and laboratory parameters for prediction of the presence of EVs have demonstrated that low platelet count/spleen diameter ratio (PC/SD) at cut-off (CO) ≤ 1121.43 cu/mm, then high SPI at CO >3.98 cm /sec then high FIB4 at CO > 2.68 then high APRI at CO > 0.6 then PVV at CO ≤ 22.2 cm/sec then high SI at CO > 89.7 and lastly Child's – Pugh's score at CO > 6 respectively.. The Non Invasive sonographic and laboratory parameters for discrimination of the size of EVs showed that high SPI was found to be the most accurate parameter at CO less than >7.75 cm/sec Then low PC/SD at CO ≤ 514.08 cu/mm then high APRI at CO > 1.4 then high FIB4 at CO > 7,6 then high SI with AUC 0.821 at CO > 122.4 then low PVV at CO < 15 and lastly Child's –Pugh's score at CO> 6 respectively.**

➢ ***Conclusions:***

**The sonographic and laboratory indices are non-invasive parameters for the prediction of EV & discrimination of its size. And to determine when Upper Endoscopy is done for liver cirrhotic patients post-C after DAAS**

***Keywords:*** *Liver Cirrhotic Patients Post C after DAAS, Esophageal Varices (EV), Portal Vein Velocity (PVV). Splenic Index (SI) Splenoportal Index (SPI), Platelet Count/Spleen Diameter Ratio (PC/SD), FIB4, APRI,Child–Pugh Score, Upper Endoscopy (UE).*

## I. INTRODUCTION

One percent of the world's population is afflicted with chronic hepatitis C virus (HCV) infection, a significant global health concern. **(Cooke et al. 2019) (Polaris 2015).**

Currently, Egypt is experiencing the largest HCV epidemic, with an estimated national prevalence of 14.7%**(Guerra et al. 2012).**

The Egyptian government decided at the beginning of 2018 to make a major push to find and treat all HCV-infected people so that the disease could be eliminated as soon as possible. **(Waked et al.2020)**.

As with other chronic liver diseases, chronic HCV infection progresses to cirrhosis, which is eventually complicated by portal hypertension (PHT). PHT causes the development of Porto systemic collaterals, which leads to the formation of esophageal varices (EV)**(Zhang et al. 2015).**

Varices are present in 60–80 percent of cirrhotic patients, with a 25–35 percent risk of bleeding. **(Amico et al.2004) .**

The variceal wall tension increases with the varices' size, and when it reaches a critical level, the varices rupture and cause life-threatening bleeding. Even when treated in a hospital, the mortality rate from variceal bleeding is about 20%..**(D'Amico et al 2003).**

Intravesical pressure is less important than the size and appearance of varices, although a portal pressure of 10 mmHg is required for varices to form and a portal pressure of 12 mmHg is required for them to bleed..(Merli et al 2003) .

After a variceal bleed, the danger of rebleeding is especially high, ranging from 60 to 70 percent over the subsequent 24 months. However, the greatest risk of rebleeding occurs within hours or days of an acute bleed. (Graci 1997). The American Association for the Study of Liver Disease and the Baveno VII Consensus Conference on PHT recommended that all cirrhotic patients be screened for the presence of EV. ***(Thomopulos et al 2015 & De Franchis 2022).***

Lack of patient compliance and the invasive nature of upper endoscopy, as well as the policy's lack of cost-effectiveness due to the inability to detect varices in a significant number of patients, limit its use. **(Talwalkar et al 2001).**

Several attempts have been made to identify non-invasive clinical, radiological, and biochemical parameters, used singly or in combination, to determine the presence of PHT and EV, such as the ratio of PC to SD, APRI, FIB-4, and FIB-7. **(Crisan et al 2012)**. As well as the portal index Spleno **(Sarangapani et al 2010)**.

➢ *This Work Aimed to:*

Study sonographic and laboratory parameters as a noninvasive diagnostic technique for prediction and examination of large varices in liver cirrhotic patients post hepatitis C virus after direct Actin antiviral drugs (DAAS).

## II. PATIENTS AND METHODS

The study was conducted on 150 Egyptian patients with HCV and liver cirrhosis after DAAS presented to the outpatient clinic and endoscopy unit at the National Liver Institute Menofiya University spanning from June 2021 to January 2022. 2023. All patients were consented before enrollment.

All Patients were divided into three arms:

**Arm 1** (no EV) **arm 2** (grades 1 & 2) and **Arm 3** (Grades 3 & 4)

➢ *Inclusion Criteria for Participants in this Research:*

Patients diagnosed with HCV-related cirrhosis after DAAS are based on clinical evaluation, laboratory findings, and ultrasonography.

➢ *The Exclusion Criteria Consisted of:*

- Patients with cirrhosis of the liver due to causes other than HCV, such as those with hepatitis B virus, autoimmune hepatitis, nonalcoholic steatohepatitis, or Wilson's disease.
- HCC patients.
- Unwilling or unable to sign the consent form.

Every participant in the study was subject to a comprehensive medical history, clinical examination, and laboratory examination, abdominal ultrasound, and sonographic parameters as the size of the liver and spleen, portal-vein-velocity (PVV). Splenic-Index (SI) Splenoportal-Index (SPI),platelet count/spleen diameter ratio (PC/SD) and upper gastrointestinal endoscopy.

Non-invasive parameter calculation (APRI, FIb4, PC /splenic diameter (SD).

➢ *Abdominal Ultrasonography:*

After an overnight fast, ultrasonography was performed on all patients, and the following information was recorded: liver echotexture, ascites, maximum vertical span of the liver, spleen size (length of its longest axis) SI (long axis x transverse axis by Cm), portal vein diameter and PVV by cm/ sec) The TOSHIBA Xario and TOSHIBA Nemio XG are pieces of real-time ultrasound equipment made by the TOSHIBA Corporation of Japan. Both of these devices use a convex array transducer with a frequency of 3.5 MHz.

➢ *Sonographic Parameters:*

The ratio of SI to mean PVV is the definition of SPI, according to the formula, SPI = SI / PVV means, whereby SI is the sonographic calculation of splenic size in square centimeters based on the maximum transverse and longitudinal measurements and PVV mean is the velocity of portal blood flow in cm/s calculated automatically by the machine with time-arranged velocity in two to three cardiac cycles and Platelet Count splenic Diameter Ratio (PCSDR)= platelet count(N/uL) / the maximum bipolar diameter of spleen ( mm ).

➢ *Upper Esophagogastroduodenoscopy (EGD)*

Patients with liver cirrhosis were then divided into three arms based on endoscopic findings: no varices, small varices, and large varices.

To evaluate EV and its grades, upper gastrointestinal endoscopy was performed on all patients. EV was assigned a 0-4 grade under the Paquet grading system. (Paquet et al 2016).

- No varices: **0**
- Varices, disappearing with insufflations: **1**
- Larger, clearly visible, usually straight varices, not disappearing with insufflations: **2**
- More prominent varices, locally coil-shaped and partly occupying the lumen: **3**
- Tortuous, sometimes grape-like varices occupying the esophageal lumen: **4**

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## III. STATISTICAL ANALYSIS

➢ *Statistical analysis of the data*

Data were fed to the computer and analyzed using IBM SPSS software package version 20.0. (Armonk, NY: IBM Corp). Qualitative data were described using numbers and percentages. The Kolmogorov-Smirnov test // Shapiro-Wilk test was used to verify the normality of distribution. Quantitative data were described using range (minimum and maximum), mean, and standard deviation, median and interquartile range (IQR). The significance of the obtained results was judged at the 5% level.

## IV. RESULTS

There were 37 females (24.7%) and 113 males (75.3%). The age ranged between 43 - 83 years, presented to the outpatient clinic and endoscopy unit at the National Liver Institute Menofiya University throughout the period from June 2021 to Jan. 2023. All patients were consented before enrollment.

According to the absence & size of EV, three arms are described. Arm 1 without varices included 30 male (78.9%) and 8 female (21.1%) with mean age 60.79 ± 3.76 years, arm 2 with small EV included 52 male (82.5%) and 11 female (17.5%) with mean age 60.27 ± 5.77 years, arm 3 with Large EV included 31 male (63.3%) and 18 female (36.7%) with mean age 63.59 ± 8.20 years, EV were more predominant in male gender among three arms without statistically significant.

There was a significant correlation between EV Size and Age in the three arms. and significantly greater in large EVs (arm 3) than in Small EVs (arm II).

There was a statistically significant difference between the three arms in terms of spleen size, ascites presence, and edema.

There were significantly higher variceal arms 2 &3 than arm 1 concerning the size of the spleen, between arms 3 than arm 1 concerning ascites, and between arms 3 than both arms 1 and 2 concerning Edema.

Table 1 Comparison between the Studied Arms According to Biochemical Liver Profile

| Biochemical liver profile | Esophagus | | | Test of Sig. | P | Sig. bet. Grps. | | |
|---|---|---|---|---|---|---|---|---|
| | Free(n = 38) | Small EV(n = 63) | Larg EV(n = 49) | | | 1 vs. 2 | 1 vs. 3 | 2 vs. 3 |
| **Bilirubin** | | | | | | | | |
| Min. – Max. | 0.43 – 1.20 | 0.29 – 4.60 | 0.30 – 8.40 | H=25.177* | <0.001* | 0.010* | <0.001* | 0.004* |
| Mean ± SD. | 0.78 ± 0.22 | 1.23 ± 0.95 | 2.94 ± 2.72 | | | | | |
| Median (IQR) | 0.80 (0.61 – 0.95) | 0.85 (0.67 – 1.29) | 1.20(0.95 – 6.20) | | | | | |
| **AST** | | | | | | | | |
| Min. – Max. | 20.0 – 56.0 | 15.0 – 240.0 | 21.0 – 195.0 | H=29.466* | <0.001* | 0.036* | <0.001* | <0.001* |
| Mean ± SD. | 38.82 ± 8.55 | 49.97 ± 30.68 | 79.35 ± 44.12 | | | | | |
| Median (IQR) | 39.5 (34.0 – 46.0) | 45.0 (36.0 – 55.0) | 66.0(45.0 – 110.0) | | | | | |
| **ALT** | | | | | | | | |
| Min. – Max. | 16.0 – 50.0 | 7.0 – 86.0 | 13.0 – 96.0 | H=13.152* | 0.001* | 0.421 | 0.001* | 0.004* |
| Mean ± SD. | 29.74 ± 7.91 | 33.14 ± 14.97 | 43.31 ± 20.17 | | | | | |
| Median (IQR) | 28.5 (26.0 – 37.0) | 31.0 (22.0 – 42.0) | 42.0 (29.0 – 54.0) | | | | | |
| **AST/ ALT ratio** | | | | | | | | |
| Min. – Max. | 1.04 – 1.56 | 0.73 – 5.33 | 0.96 – 3.60 | H=25.165* | <0.001* | 0.088 | <0.001* | <0.001* |
| Mean ± SD. | 1.33 ± 0.14 | 1.58 ± 0.66 | 1.86 ± 0.62 | | | | | |
| Median (IQR) | 1.36(1.20 – 1.44) | 1.35(1.19 – 1.76) | 1.72(1.47 – 2.14) | | | | | |
| **ALP** | | | | | | | | |
| Min. – Max. | 46.0 – 112.0 | 44.0 – 147.0 | 42.0 – 184.0 | H=2.950 | 0.229 | >0.05 | >0.05 | >0.05 |
| Mean ± SD. | 71.63 ± 19.38 | 73.24 ± 23.16 | 80.53 ± 27.77 | | | | | |
| Median (IQR) | 71.0 (54.0 – 87.0) | 67.0 (56.0 – 83.0) | 74.0 (62.0 – 92.0) | | | | | |
| **Albumin** | | | | | | | | |
| Min. – Max. | 3.0 – 4.30 | 2.10 – 4.50 | 1.80 – 4.70 | F=22.598* | <0.001* | <0.001* | <0.001* | 0.016* |
| Mean ± SD. | 3.89 ± 0.38 | 3.35 ± 0.63 | 3.05 ± 0.64 | | | | | |
| Median (IQR) | 4.0 (3.80 – 4.10) | 3.50 (2.85 – 3.90) | 3.0 (2.60 – 3.40) | | | | | |
| **Prothrombin time** | | | | | | | | |
| Min. – Max. | 49.50 – 76.55 | 43.10 – 82.50 | 38.0 – 71.90 | F=23.704* | <0.001* | 0.601 | <0.001* | <0.001* |
| Mean ± SD. | 64.42 ± 8.49 | 62.72 ± 9.01 | 53.16 ± 8.09 | | | | | |
| Median (IQR) | 66.5 (55.8 – 72.2) | 64.2 (57.7 – 68.7) | 52.1 (48.3 – 56.5) | | | | | |

➢ *Bilirubin:*

The mean level of Bilirubin for arm 1 was 0.78 ± 0.22, 1.23 ± 0.95 for arm 2, and 2.94 ± 2.72 for arm 3 with the significant value among three arms and a significant value greater in variceal arms 2 &3 than arm 1 (Non-variceal arm). And variceal arms 3 than 2 (larger than small variceal arms).

➢ *AST:*

The mean level of AST for arm 1 was 38.82 ± 8.55, 49.97 ± 30.68 for arm 2, and 79.35 ± 44.12 for arm 3 with a significant value among three arms and a significant value greater in variceal arms 2 and 3 compared to arm 1, and arm 3 compared to arm 2.

➢ *ALT:*

The mean level of ALT for arm 1 was 29.74 ± 7.91, 33.14 ± 14.97 for arm 2, and 43.31 ± 20.17 for arm 3 with a significant value among three arms and a significant value higher in (arm 3 than arm 1 and with an insignificant value between arm 2 and arm 1.

➢ *AST/ALT Ratio:*

The mean level of AST for arm 1 (no varices) were 1.33 ± 0.14, 1.58 ± 0.66for arm 2 (small varices), And 1.86 ± 0.62for arm 3 (large Varices) with a significant value among three arms and significant value higher in variceal arms 2 and 3 than arm 1 and arm 3 than 2.

➢ *Alkaline phosphatase:*

The mean levels for arm 1 were 71.63 ± 19.38, 73.24 ± 23.16 for arm 2, and 80.53 ± 27.77 for arm 3 without any significant value among three arms and insignificant value between arm 1 and variceal arms 2&3. And Between arm 3 and arm 2.

➢ *Albumin:*

The Mean level of Albumin for arm 1 (no varices) was 3.89 ± 0.38

, 3.35 ± 0.63 for arm 2 (small varices) And 3.05 ± 0.64 for arm 3 (large Varices) with a significant value among the three arms and a significant value reduced in variceal arms 2 and 3 than arm 1 and Also between arm 3 and arm 2.

➢ *Prothrombin time:*

The Mean level of Prothrombin time concentration for arm 1 was 64.42 ± 8.49, 62.72 ± 9.01 for arm 2and 53.16 ± 8.09 for arm 3 with a significant value among three arms and statistically significant value lower in arm 3 than arm I, with insignificant value between arm 2and arm 1 and there was significant value lower value between arm 3 and arm.

There were significant values among the three arms concerning elevated Bilirubin, AST, ALT, AST/ ALT, and reduced levels of Albumin and prothrombin time concentration, and insignificant values among the three arms concerning ALP.

There were significant values higher in arm 2(Small variceal arm) than in arm 1 (Non-variceal arm) concerning elevated Bilirubin, AST, AST/ALT, and reduced Albumin and in arm 3 (Large variceal arm) than in arm 1 (Non-variceal arm) and arm 2(Small variceal arm) concerning elevated Bilirubin, AST, ALT, AST/ ALT and reduced level of Albumin and prothrombin time concentration.

Table 2 Comparison between the Studied Arms According to CBC

| CBC | Esophagus | | | Test of Sig. | P | Sig. bet. Grps. | | |
|---|---|---|---|---|---|---|---|---|
| | Free(n = 38) | Small EV(n = 63) | Large EV(n = 49) | | | I vs. II | I vs. III | II vs. III |
| **HB** | | | | | | | | |
| Min. – Max. | 9.0 – 13.0 | 6.90 – 15.70 | 5.40 – 15.80 | F= 17.871* | <0.001* | 0.021* | <0.001* | 0.001* |
| Mean ± SD. | 11.24 ± 1.18 | 10.26 ± 1.91 | 8.98 ± 1.96 | | | | | |
| Median (IQR) | 11.3 (10.5 – 12.0) | 9.80 (8.80 – 11.3) | 8.70 (7.70 – 10.2) | | | | | |
| **WBC** | | | | | | | | |
| Min. – Max. | 3.0 – 10.0 | 1.60 – 15.40 | 1.50 – 14.0 | H= 19.106* | <0.001* | <0.001* | <0.001* | 0.531 |
| Mean ± SD. | 6.56 ± 1.93 | 5.06 ± 2.49 | 4.79 ± 2.57 | | | | | |
| Median (IQR) | 6.60 (5.20 – 8.0) | 4.20 (3.40 – 6.55) | 4.20 (3.10 – 5.50) | | | | | |
| **PLT** | | | | | | | | |
| Min. – Max. | 143.000 –221.000 | 160.0 – 1790.0 | 90.000 – 57.000 | H= 121.10* | <0.001* | <0.001* | <0.001* | <0.001* |
| Mean ± SD. | 178000.405 ± 194.8 | 110000.709 ± 214.1 | 54000,609 ± 237.9 | | | | | |
| Median (IQR) | 178.000 (168.000 191,000) | 112.000 (970.0 – 121.000) | 53.000 (39.000 – 68.000) | | | | | |

➢ *Hemoglobin:*

The Mean levels of Hemoglobin for arm 1 were 11.24 ± 1.18, 10.26 ± 1.91 for arm 2and 8.98 ± 1.96 for arm 3 with a significant value among the three arms and a significant value lower in variceal arms 2 and 3 than arm and Also between arm 3 and arm 2.

➢ *White Blood Cells (WBCs):*

The Mean level of WBCs for arm 1 was 6.56 ± 1.93, 5.06 ± 2.49 for arm 2and 4.79 ± 2.57 for arm 3 with statistically significant values among the three arms and significant values lower in variceal arms 2 and 3 than arm 1 and Also between arm 3 and arm 2.

➢ *Platelets:*

The Mean value level of Platelets count for arm 1 was 178.000 (168.000 ± 194.8), 110000.709 ± 214.1for arm 2, and 54000,609 ± 237.9 for arm 3 with a significant value among the three arms and statistically significant value lower in variceal arms 2 and 3 than arm 1 and Also between arm 3 and arm 2. There was a significant value among the three arms in relation to low levels of hemoglobin (HB), white blood cells (WBC), and Platelets (PLT). There was a significant value lower in variceal arms 2 and 3 than in arm 1 and Also between arm 3 and arm 2(large and small variceal arm) in relation to low levels of HB, WBCs, and PLT.

Table 3 Child-Pugh Score in Three Arms:

| | Esophagus | | | | | | Test of Sig. | p | Sig. bet. Grps. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Free (n = 38) | | Small OV(n = 63) | | Large OV(n = 49) | | | | I vs. II | I vs. III | II vs. III |
| | No. | % | No. | % | No. | % | | | | | |
| **Child pough score** | | | | | | | | | | | |
| A | 33 | 86.8 | 35 | 55.6 | 3 | 6.1 | $\chi^2$= 63.789* | <0.001* | $^{MC}$p= 0.003* | <0.001* | <0.001* |
| B | 5 | 13.2 | 25 | 25 | 33 | 67.3 | | | | | |
| C | 0 | 0.0 | 3 | 4.8 | 13 | 26.5 | | | | | |
| Min. – Max. | 5.0 – 7.0 | | 5.0 – 11.0 | | 5.0 – 12.0 | | F= 33.014* | <0.001* | 0.005* | <0.001* | <0.001* |
| Mean ± SD. | 5.76 ± 0.68 | | 6.65 ± 1.40 | | 8.10 ± 1.69 | | | | | | |
| Median (IQR) | 6.0(5.0 – 6.0) | | 6.0(6.0 – 7.50) | | 7.0(7.0 – 10.0) | | | | | | |

➢ *Child-Pugh score:*

Arm 1 showed that Thirty-Three (86.8 %) had Child's A class liver disease, 5 (13.2%) had Child's class B disease while no patient had Child's C class disease. Arm 2 showed 35 (55.6%) had Child's A class liver disease, 25(25%) had Child's B class disease and 3 (4.8%) patients had Child's C class disease. Arm 3 showed 3 (55.6 %) had Child's A class liver disease, 33(67.3%) had Child's B class disease, and 13 (26.5%) patients had Child's C class disease.

The meanChild–Pugh score in arm 1 was 6.0(5.0–6.0) while in arm 2 was 6.0(6.0–7.50) and in arm 3 was 7.0(7.0–10.0) with a significant value among three arms in the prediction of the presence of EV and significant value in prediction of large varices with an advanced score.

There was a significant value between variceal arms 2 and 3 than Arm 1 in the prediction of the presence of EV with advanced score and a significant value between Arm 3 and Arm 2 in the prediction of large varices.

➢ *Portal vein diameter:*

The mean Portal vein diameter in arm 1 was 12.23 ± 0.57 mm, arm 2 was 13.27 ± 2.18 mm and arm 3 was 12.98 ± 2.18 mm with a significant value greater in arm 2 than arm I, with insignificant value between arm 3 and arm 1 and between arm 3 and arm 2.

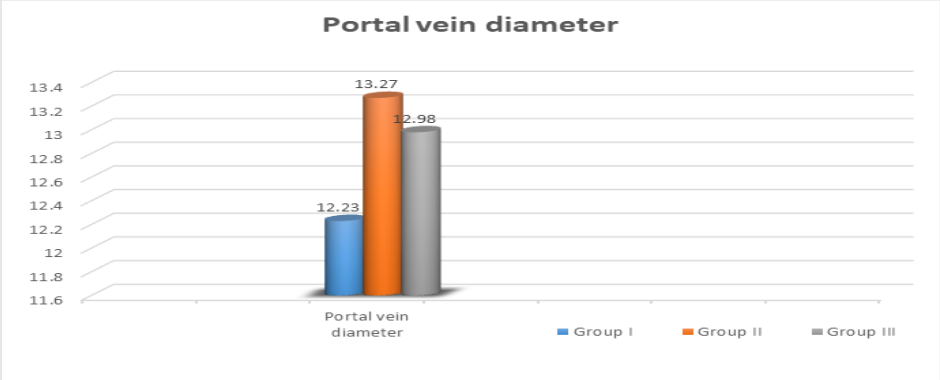


Fig 1 The Mean Value for Portal Vein Diameter in 3 Arms

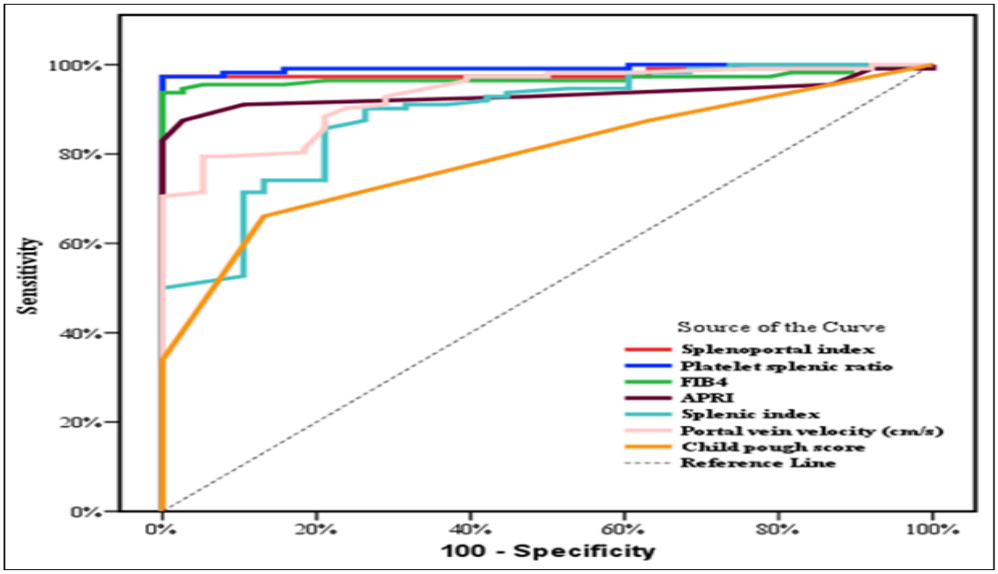


Fig 2 ROC Curve for Different Scores as Regards their Ability to Predict the Presence of EV (n = 112) from Non- EV (n = 38)

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Table 4 Prediction Power Criteria for Different Scores to Predict EV

| | AUC | P | 95% C.I | Cut off | Sensitivity | Specificity | PPV | NPV | Accuracy |
|---|---|---|---|---|---|---|---|---|---|
| **Splenoportal index** | 0.980 | <0.001* | 0.958 – 1.0 | >3.98 | 97.32 | 86.84 | 95.6 | 91.7 | 94.67 |
| **Platelet splenic ratio** | 0.992 | <0.001* | 0.981 – 1.0 | ≤1121.43 | 98.21 | 92.11 | 97.3 | 94.6 | 97.98 |
| **FIB4** | 0.969 | <0.001* | 0.940 – 0.998 | >2.68 | 95.54 | 92.11 | 97.3 | 87.5 | 94.67 |
| **APRI** | 0.933 | <0.001* | 0.892 – 0.974 | >0.6 | 91.07 | 89.47 | 96.2 | 77.3 | 90.66 |
| **Splenic index** | 0.887 | <0.001* | 0.830 – 0.944 | >89.7 | 85.71 | 78.95 | 92.3 | 65.2 | 84.0 |
| **Portal vein velocity (cm/s)** | 0.932 | <0.001* | 0.894 – 0.971 | ≤22.2 | 91.07 | 71.05 | 90.3 | 73.0 | 86.0 |
| **Child pough score** | 0.795 | <0.001* | 0.724 – 0.867 | >6 | 66.07 | 86.84 | 93.7 | 46.5 | 71.33 |

EV (n = 112) from Non- EV (n = 38)

ROC (Receiver operator characteristic) curve for sonographic and laboratory parameters to find out the best cut-off (CO) of Platelets count/ SD ratio, SPI, FIB4 and APRI, SI and PVV & detection of sensitivity & specificity at this point that could predict EV in cirrhotic post-HCV after direct-acting antiviral drugs (DAAs)

- *(PCSDR)***:**

The area under the curve (AUC) was calculated to be 0.992%.with a significant value greater in the variceal arm than non-variceal arm (P < 0.001) with the best CO to be ≤ 1121.43, The sensitivity was (98.21%), specificity (92.11%), and diagnostic Accuracy (97.98%).

- *SPI***:**

We found that the AUC was 0.980 with a significant value higher in the variceal arm than non-variceal arm (P < 0.001) with the best CO to be > 3.98, The sensitivity was (97.32%), specificity (86.84%), and diagnostic Accuracy (94.67%).

- *FIB4:*

We found that the AUC was 0.969 with a significant value greater in the variceal arm than non-variceal arm (P < 0.001) with the best CO to be >2.68, the sensitivity was (95.54%), specificity (92.11and Diagnostic Accuracy (94.67%).

- *APRI:*

We found that the AUC was 0.933 with a significant value greater in the variceal arm than non-variceal arm (P < 0.001) with the best CO to be > 0.6, the sensitivity was (91.07%), specificity (89.47%), and diagnostic Accuracy (90.66%).

- *SI:*

We found that the AUC was 0.887 with a significant value greater in the variceal arm than non-variceal arm ( P < 0.001 ) with the best CO to be >89.7 As shown in figure (2)

The sensitivity was (85.71%), specificity (78.95%), positive predictive value (PPV) (92.3%), negative predictive value (NPV) (65.2%), and diagnostic Accuracy (84.0%).

- *PVV:*

We found that the AUC was 0.932 with a significant value higher in the variceal arm than non-variceal arm (P < 0.001) with the best CO to be ≤22.2, The sensitivity was (91.07 %), specificity (71.05 %), PPV (90.3 %), NPV (73.0 %) and diagnostic Accuracy (86.0%).

We found that the child–Pugh score AUC was 0.795 with a significant value higher in the variceal arm than non-variceal arm (P < 0.001) with the best CO to be >6, The sensitivity was (66.07 %), specificity (66.07%), PPV (93.7 %), NPV (46.5 %) and diagnostic Accuracy (71.33 %). When predicting EV, a Child-Pugh score came six.

- *In Conclusion*

The AUC and diagnostic Accuracy for Platelet/splenic ratio was > SPI > FIB4, APRI > PVV > SI >Child–Pugh score for prediction EV in post-HCV liver cirrhotic patients after DAAs.

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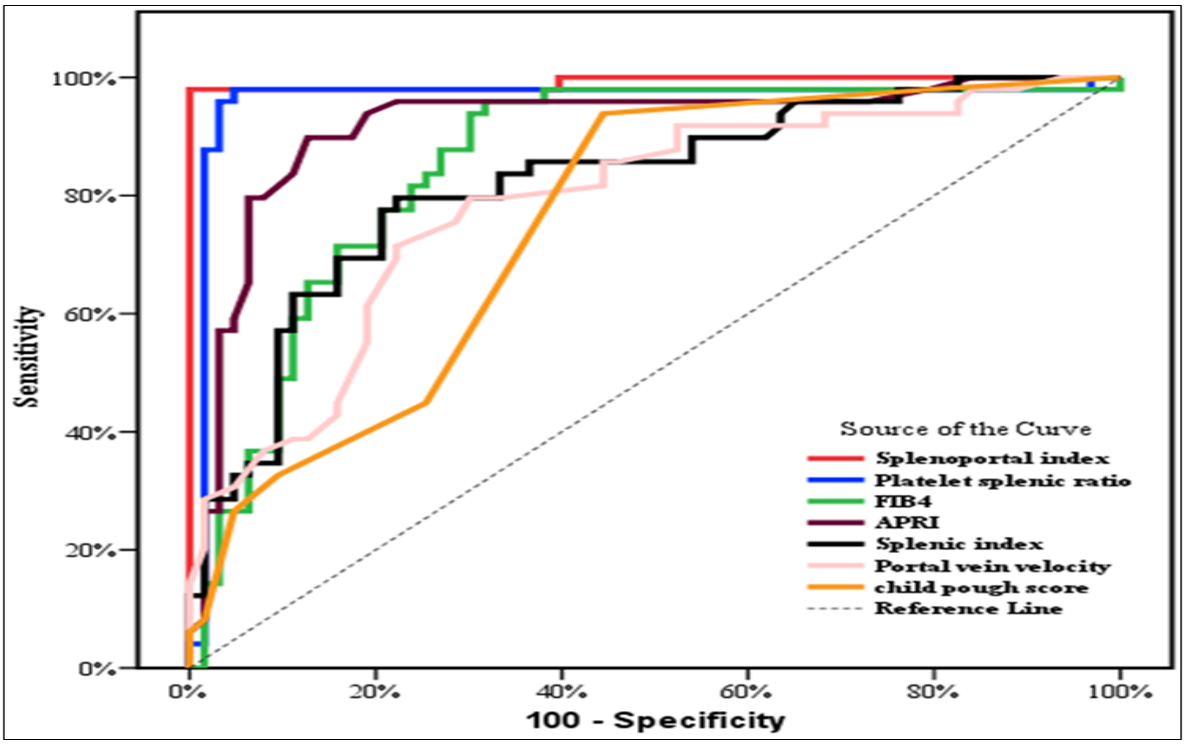


Fig 3 ROC Curve for Different Scores to Predict Large OV

Table 5 Prognostic Performance for Different Parameters to Discriminate Large EV (n = 49) from Small OV (n = 63)

| | AUC | P | 95% C.I | Cut off | Sensitivity | Specificity | PPV | NPV | Accuracy |
|---|---|---|---|---|---|---|---|---|---|
| **Splenoportal index** | 0.992 | <0.001* | 0.976 – 1.0 | >7.75 | 97.96 | 96.83 | 96.0 | 98.4 | 97.67 |
| **Platelet splenic ratio** | 0.963 | <0.001* | 0.916 – 1.0 | ≤514.08 | 97.96 | 95.24 | 94.1 | 98.4 | 97.27 |
| **FIB4** | 0.855 | <0.001* | 0.782 – 0.928 | >7.66 | 87.76 | 73.02 | 71.7 | 88.5 | 84.03 |
| **APRI** | 0.919 | <0.001* | 0.861 – 0.977 | >1.4 | 93.88 | 80.95 | 79.3 | 94.4 | 90.60 |
| **Splenic index** | 0.821 | <0.001* | 0.741 – 0.900 | >122.4 | 79.59 | 77.78 | 73.6 | 83.1 | 79.13 |
| **Portal vein velocity (cm/s)** | 0.786 | <0.001* | 0.700 – 0.871 | ≤15 | 75.51 | 71.43 | 67.3 | 78.9 | 74.48 |
| **Child pough score** | 0.754 | <0.001* | 0.665 – 0.843 | >6 | 93.68 | 55.56 | 62.2 | 92.1 | 72.24 |

ROC finds out the best CO of PC/ SD ratio, SPI, FIB4, APRI, SI, and PVV & detection of sensitivity & specificity at this point that discriminate Large OV (arm 3) from small ( OV arm 2) in cirrhotic post-HCV after DAAs.

➢ *SPI:*

We found that the AUC was 0.992 with a significant value higher in the large variceal arm ( GP 3 ) than small variceal arm ( GP 2 ), ( P < 0.001 ) with the best cut of CO to be >7.75, The sensitivity was (97.96%), specificity (96.83%), PPV (96.0%), NPV (98.4%) and diagnostic Accuracy (97.67%).

➢ *(PCSDR) :*

We found that the AUC was 0.963 with a significant value higher in the large variceal arm ( GP 3 ) than small variceal arm ( GP 2 ), ( P < 0.001 ) with the best CO to be ≤514.08, The sensitivity was (97.96%), specificity (95.24%), PPV (94.1%), NPV (98.4%) and diagnostic Accuracy (97.27%).

➢ *APRI:*

We found that the AUC was 0.919 with a significant value higher in the large variceal arm ( GP 3 ) than small variceal arm ( GP 2), ( P < 0.001 ) with the best CO to be >1.4, The sensitivity was (93.88%), specificity (80.95%), PPV (79.3%), NPV (94.4%) and diagnostic Accuracy (90.60%).

➢ *FIB4:*

We found that the AUC was 0.855 with a significant value higher in large variceal arm ( GP 3 ) than small variceal arm ( GP 2 ), ( P < 0.001 ) with the best CO to be >7.66 and diagnostic Accuracy (84.03%).

➢ *SI:*

We found that the AUC was 0.821 with a significant value higher in the large variceal arm ( GP 3 ) than small variceal arm ( GP 2 ), ( P < 0.001 ) with the best CO to be >122.4, The sensitivity was (79.59 %), specificity (77.78 %), PPV (71.7%), NPV (83.1%) and diagnostic Accuracy (79.13%).

➢ *PVV:*

We found that the AUC was 0.786 with a significant value higher in the large variceal arm (GP 3) than small variceal arm (GP 2), (P < 0.001) with the best CO to be ≤15 and diagnostic Accuracy (74.48%).

➢ *Child-Pugh score:*

We found that the AUC was 0.754 with a significant value higher in the large variceal arm (GP 3) than in small GP 2 (P < 0.001) with the best CO to be >6

The sensitivity was (93.68 %), specificity (55.56 %), PPV (62.2 %), NPV (92.1 %), and diagnostic Accuracy (72.24 %).Child–Pugh score came six in Discrimination of Large EV.

➢ *In Conclusion:*

The AUC and diagnostic Accuracy for SPI > Platelet/splenic ratio > APRI > FIB4 > SI > PVV >Child–Pugh score for Discrimination of Large EV (arm 3) from small (OV arm 2) in post-HCV liver cirrhotic patients after DAAs.

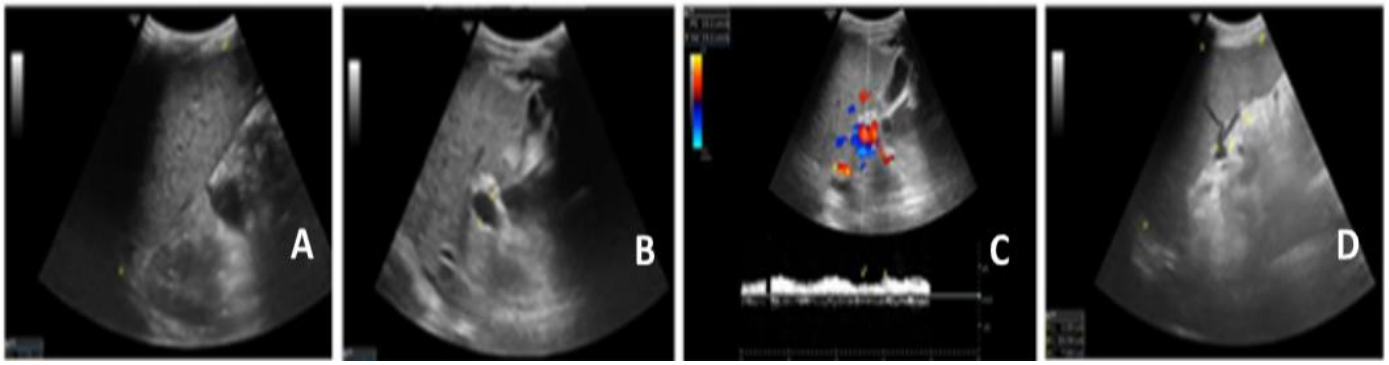


Fig 4 (A-D): A male patient 55 year old presented with grade III EV post DAAS therapy with platelet count 86000 n/ul.Abdominal ultrasonography reveals cirrhotic liver with liver span 13 cm (A),PV diameter 14.5mm (B), PVV 15.1cm/sec (C), longitudinal and transverse splenic diameters 20.39cm and 7.69cm. SI-20.39x7.69=156.79, SPI=156.79/15.1-10.38, PCSDR =86000/203.9=421.77

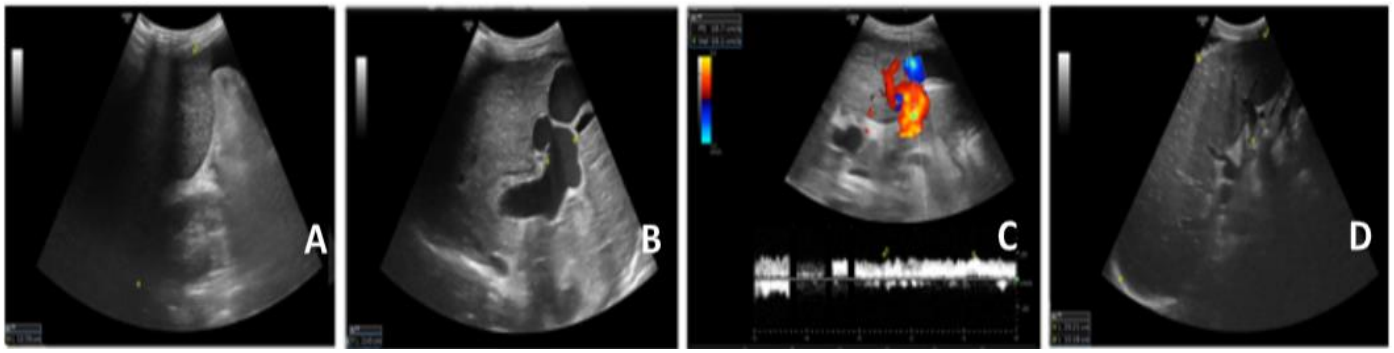


Fig 5 (A-D): A male patient 60 year old presented with grade IV EV post DAAS therapy with platelet count 63000 n/ul. Abdominal ultrasonography reveals cirrhotic liver with liver span 12.39cm (A), PV diameter 24.5mm (B), PVV 18.1cm/sec (C), longitudinal and transverse splenic diameters 29.21cm and 10.18cm. SI=29.21x10.18=297.35, SPI-297.35/18.1=16.42, PCSDR =63000/292.1=215.67

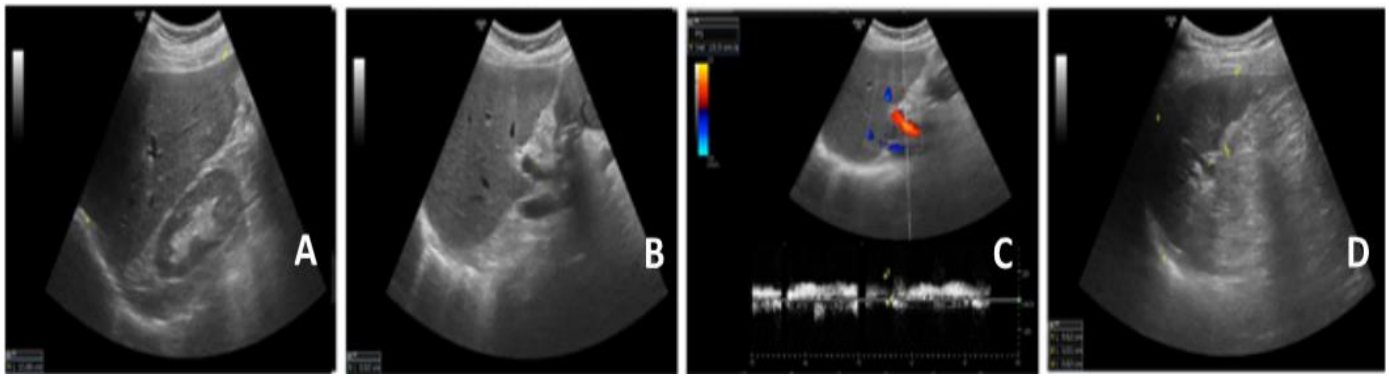


Fig 6 (A-D):A female patient 40 year old post DAAS therapy with no EV and platelet count 176000 n/ul. Abdominal ultrasonography reveals early cirrhotic liver with liver span 15.86cm (A),PV diameter 9.2mm (B), PVV 13.8cm/sec (C), longitudinal and transverse splenic diameters 9.62cm and 5.01cm. SI-9.62x5.01-48.19, SPI=48.19/13.8=3.49, PCSDR =176000/96.2=1829.5

## V. DISCUSSION

Patients with cirrhosis due to chronic HCV infection were clustered into similar subgroups in the current study population before the introduction of DAAS., Patients with cirrhosis due to chronic HCV infection were clustered into similar subgroups in the current study population before the introduction of DAAS..

Therefore, Non-endoscopic models that can predict the presence of high-risk varices are of significant interest. These studies have shown that the presence of EV can be accurately predicted using clinical, laboratory, and sonographic variables. ***(Garcia-Tsao et al., 2006 & Ismail et al., 2008).***

The current study showed that EVs were more predominant in the male gender among three arms without a significant value. Several studies have found that males and females experience different rates of liver disease progression. ***(Gu et al., 2013).***

In contrast to men, who make up between 55 to 70 percent of all cases, women have a much lower risk of developing chronic liver disease and are thought to have a better prognosis.***(Kim et al., 2002 & Ratib et al., 2015).***

Liver fibrosis caused by viral hepatitis or nonalcoholic steatohepatitis is less likely to progress in females. The lower rate of fibrosis progression in females is likely attributable to the protective effect of sex hormones. ***(Yang et al., 2014)*** .It has also been documented that women experience a lower incidence of hepatic decompensation than men. ***(Rubin et al., 2020)*** . It has been observed that the outcome of variceal bleeding varies by gender and country. According to a study of 266 patients in Norway, women with cirrhosis and variceal bleeding have a lower mortality risk than men.***(Haukeland et al., 2020).*** In accordance to our study ***(Fabian et al., 2019*** showed that females admitted to the hospital with variceal bleeding had a lower mortality rate than males.***(Fabian et al., 2019).***

All of these studies enrolled cirrhotic patients with different causes (viral, alcoholic, autoimmune, and mixed) and disease severity. However, in our study, all patients had liver cirrhosis post-C and after DAAS treatment.

Our study showed that age can provide a predictable factor for the large size of EV; there was a significant value directly proportional between the Size of EV and Age among the three arms and significantly greater in large EV (arm 3) than in Small EV (arm 2). These findings agree with the findings reported by ***Zhao et al. 2022 and Berger et al. 2021*** who found that the prevalence of high-risk varices increases significantly with age.

Our results of clinical findings showed that the large size of the spleen can provide a predictable factor for the presence of EV and directly proportion to the size of the spleen.

Ascites can provide predictable factors for the presence of large EVs.

Edema can provide a predictable factor for the prediction and determination of the size of EVs.

Several studies similar to our findings shown independent parameters like splenomegaly***, (Amarapurkar et al., 1994, Chalasani et al., 1999, Madhotra et al., 2002, Thomopoulos et al., 2003)*** ascites, ***(Pilette et al., 1999)*** Lower limb oedema ***(Elsherif et al., 2022)*** Child's grade, ***(Zaman et al., 2001)*** *as predictive factors for the presence of EV.*

The logistic regression analysis of the Biochemical analysis of three studied arms showed that high AST, AST/ALT ratio, and low Serum albumin, can provide information for predicting EV Presence between the cirrhotic variceal arm (arm 2& arm 3) and the cirrhotic nonvariceal arm (arm I). High serum Bilirubin, AST, ALT, AST/ ALT ratio, and low level of Albumin and prothrombin time concentration in arm 3 (Large variceal arm) than arm 1 (Non-variceal arm) and arm 2(Small variceal arm) can provide information for discrimination of the size of EV.

Bilirubin's mean level for three arms was: 0.78 for arm I, 1.23 for arm 2and 2.94 for arm 3, and showed that Bilirubin can provide information for the presence and discrimination of the size of EV.

AST mean levels for three arms were: 38.82 for arm 1, 49.97 for arm 2and 79.35 for arm 3. And showed that AST can provide information for the presence and discrimination of the size of EV.

ALT mean levels for three arms were: 29.74 for arm I, 33.14 for arm 2and 43.31 for arm 3 showing that ALT can provide information for the presence of EV with a significant value higher between large variceal and non-variceal arms and ALT is higher in small variceal than non-variceal arms but without a significant value, and for the size of EV.

AST/ALT ratio mean level (The test of time = The De Ritis Ratio) for three arms was: 1.33 for arm I, 1.58 for arm 2and 1.86 for arm 3 and showed that AST/ALT can provide information for the presence and discrimination the size of EV.

***Botros & Sikaris 2013*** Demonstrated that the ratio of AST to ALT represents the aggressiveness and rate of disease progression (36 h). A raised AST/ALT ratio is predictive of long-term complications such as fibrosis and cirrhosis in chronic viral diseases like chronic viral hepatitis and chronic alcoholism, as well as in non-alcoholic fatty liver disease.

The Albumin levels were: 3.89 for arm I, 3.35 for arm 2and 3.05 for arm 3, and Albumin can provide information for the presence and discrimination of the size of EV.

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The prothrombin time concentration mean level for the three arms was: 64.42 for arm I, 62.72 for arm 2and 53.16 for arm 3 showing that Prothrombin time concentration can provide information for the presence and discrimination of the size of EV.

Consistent findings were also reported by***( Camma. , Petta et al., 2009 and Nashaat et al., 2010. )*** Liver profile parameters and the presence of varices have been shown to have a strong correlation in other studies.***Pilette et al.,1999, Schepis et al., 2001, Bressler et al., 2005 ,Berzigotti et al., 2008.and Elsherif et al., 2022.***

Our findings regarding serum albumin were also consistent with those of of***Shehata et al., 2014***, Who evidenced that an albumin level of in the blood 3.8 indicated EV infection Nonetheless, studies of **Galal et al.2012**, Serum albumin could predict the presence of EV a cutoff of 3.2 or less, was reported. and the study by ***ELNaggar et al. 2012,*** Reported that at a CO of 3.3 or less serum albumin could predict the presence of EV.

Regarding Prothrombin time concentration, several studies have reported that PT is related to EVs. At a cutoff greater than 17.05**,** With a sensitivity of 68.8 and a specificity of 81.8 percent, PT was found to be a predictor for EVs in cirrhotic patients by ***Zaman et al. (2011).***

At a CO greater than 15.1 seconds, Elatty et al. 2019 found a statistically significant distinction between the cirrhotic variceal and nonvariceal arms in the PT prediction of EV.

The logistic regression analysis of Complete Blood Picture (CBC) low level of HB, WBCs, and PLT of three studied arms showed that there was a significant value between arm 2& arm 3 and arm 1 in the prediction of EV. And between arm 3 and arm 2in prediction of the size of EV. The same findings were reported by ***Elsherif et al. 2022 and Gue et al. 2004.***

The cause of anemia in patients with EV: EV and gastric or portal hypertensive gastropathy may be associated with chronic slow blood loss. and development of chronic iron deficiency anemia, Chronic inflammation; liver disease associated with chronic inflammation, Lower Erythrobiotine level with more liver damage leading to a decrease in red cell production, Hypersplenism; the spleen breaks down red blood cells far more quickly than they are produced, Malnutrition & malabsorption; Nutrients like iron, vitamin B12, and Folate are important for red cell production and Medications; as interferon, ribavirin or azathioprine ***(Sethi et al., 2023).***

White Blood Cells (WBCs) can provide information for the prediction of the presence of EV, The Mean of WBCs for arm 1 were 6000.56, 5000.06 for arm 2and 4000.79 for arm 3 with a significant value lower in the large variceal arm and small variceal arm (presence of EV) than a non-variceal arm. And large variceal arm is lower than the small variceal arm but with an insignificant value. Consistent with the findings of Gue et al. (2004), who discovered that if WBCSs were > 4000/ cubic mm, the diagnostic yield for varices grades 2 and 3 was 19.4 percent. Leucopenia and white blood cell (WBC) count can be used to stratify the risk of developing EV in cirrhotic patients (66.7 percent if total WBCs 3000-4000, and 94.8 percent if WBC count is 3000 cubic mm).

Platelets (PLT) can provide information for predicting the presence and size of (EVs.; The Mean of PC for arm 1 (no variceal arm) was 178000.405, 110000.709 for arm 2(small variceal arm), And 54000,609 for arm 3 (large Variceal arm) with a significant value lower in large variceal and small variceal arms than a non-variceal arm and Also between large and small variceal arm.

Chalasani et al., 1999 (346 patients) reported that a platelet count of 88.000/mm3 was an independent risk factor for the presence of large varices; this was later confirmed by Sarwar et al., 2005.

Patients without varices had a higher PC (mean PC, 128,500/mm3) than those with small varices (mean PC, 107,800/mm3), and a PC of 90,000/mm3 almost multiplied the risk of having a large E.V. by 2.5 times, as reported by Zaman et al., 2001. Low PC is an independent risk factor for the onset of varices (Garcia-Tsao et al., 1997; Pilette et al., 1999; Thomopoulos et al., 2003).

## VI. THE NON-INVASIVE ULTRASOUND PARAMETERS

The presence of varices was found to be significantly correlated with PV diameter, PVV, SI, SPI, and low PCSDR, as determined by logistic regression analyses of our sonographic parameters.

The mean diameter of the portal vein was 12.2mm in Arm 1, 13.27mm in Arm 2, and 12.98mm in Arm 3.

Our results showed that Portal vein diameter was a predictable factor for the presence from the absence of EV with a significant value higher between small variceal and non-variceal arms and mean Portal vein diameter higher for large variceal than non-variceal arms without a significant value, and for large variceal arm than small variceal arm but without a significant value as a discriminant predictor for the size of EV.

The presence of EV and PVD larger than 13 mm and inversion of flow within the portal system are both diagnostic of clinically significant PHT, as demonstrated by Berzigotti et al.

Researchers have found that a PV diameter of 13 mm is an accurate predictor of EV in cirrhotic patients (Giannini et al., 2003; Gill et al., 2004). The optimum CO for a PV diameter of 13.5 mm was also reported by Nashaat et al., A PVD of >13 mm for small EVs and >14 mm for large EVs was confirmed by Cherian et al. (2011).

At a CO of 15.2 mm, Elatty et al. 2019 found a statistically significant distinction in PVD for EV prediction between the variceal and non-variceal arms.

The difference in the our results from other studies may be because this study was conducted on cases post hepatitis C liver cirrhosis after DAAS, unlike other studies that were conducted on patients suffering from active hepatitis C virus or other causes of cirrhosis.

SI was a predictable factor for the presence of EVs and Also for Discrimination for the size of EVs.

Amarapurkar et al. (1994) reported that splenomegaly alone is a strong predictor of the emergence of large EVs.., According to these results, splenomegaly alone was a strong predictor of the emergence of large EVs. In a prospective study, splenomegaly was identified as a diagnostic sign of cirrhosis and PHT by Chalasani et al. (1999)., According to research by Sharma et al. (2007), splenomegaly is a reliable indicator of the presence of large varices, Independent predictors of large EV have been reported by Nashaat et al. (2010) and Cherian et al. (2011), who found that a best CO for the transverse splenic diameter >145 mm and a mean bipolar splenic dimension >160 mm were both significant.

Both the presence of EVs and the ability to distinguish between EVs of different sizes could be predicted using PVV. Consistent with previous research showing a negative correlation between portal pressure and the presence of EVs (Korner 1996; Erdozain et al., 2000; Yin et al., 2001; Liu et al., 2008).

SPI was a predictor of the presence of EVs, as well as the discrimination of large EVs. When portal resistance increases in cirrhosis, stagnant portal blood flow causes an increase in the resistance of splenic venous outflow, resulting in congestive splenomegaly. Splenomegaly, brought on by increased blood flow to the spleen, also makes PHTN worse. Extracellular vesicle formation is stimulated and splenomegaly is made worse by elevated portal pressure. ***(Iwao et al; 1997).*** Previous research also demonstrated a correlation between the decrease in mean PVV the severity of PHTN and the risk of EV bleeding. ***(Iwao et al; 1997).*** This non-invasive index demonstrated correct diagnoses with a sensitivity of 79.4 percent and a specificity of 72 percent when set to 3.5 cm/s.***(Wadhwa, et al 2014).***

In line with what was discovered by Liu et al (2008), who found that SPI has a stronger correlation with varices than SI and mean PVV. Furthermore, SPI's diagnostic accuracy (AUC) in our series was similar to that reported by Liu et al (2008). (0.93)

The PC/SD ratio was useful for both detecting the presence of EVs and differentiating between comparatively small and large EVs. The presence of EV has been linked to PC/D in a number of studies. According to a 2002 study by Malhotra et al., thrombocytopenia is a common complication of liver cirrhosis, affecting up to 76% of patients**.**, 50,000 uL to 75,000 uL) occurs in approximately 13% of cirrhotic patients. Multiple factors contribute to the development of thrombocytopenia in these patients. Splenic sequestration may be caused by either of two potential mechanisms... One is crucial, involving myelosuppression as a result of hepatitis viruses or myelotoxicity as a result of excessive alcohol consumption., Second, antibodies that attack platelets are present in the body. Furthermore, it is condition and cause-specific. ***(Watanabi et al 2000).*** Splenomegaly is common, particularly in patients with non-alcoholic cirrhosis, due primarily to congestion of the red pulp of the spleen caused by PHTN. Local and Western studies demonstrated greater sensitivity and specificity for PCSDR with a CO of 909.

***Giannini et al. 2003, and Agha et al. (2009***) showed that the PC/SDR ratio had 100% sensitivity, 97% specificity, and 100% positive predictive value for detecting the presence of EV at a CO of 909. ***Sheta et al. (2018)*** discovered a significant relationship between the presence and grade of EV (P0.001) at a CO 570, with a sensitivity of 77.19% and a specificity of 93.02%. and With an 81% sensitivity and an 81% specificity, the CO of the PC/SD ratio (750) was found to be optimal for predicting EV by El Hady et al., 2016.

The AUC for Platelet/splenic ratio was > SPI was more accurate in predicting the presence of EV. The AUC for SPI > PC/SDR was more accurate for discriminating Large EVs.

When evaluating the sensitivity, specificity, and diagnostic accuracy of non-invasive parameters for detecting EVs in our population, we found that both PCSDR and SPI performed very well. However, CO was greater when compared to ***Giannini et al;2003***. This discrepancy may be best explained by the fact that the majority of patients in our study had cirrhosis caused by viruses, whereas the most common causes of cirrhosis in the West are non-viral, including alcoholic cirrhosis, metabolic cirrhosis, primary biliary cirrhosis, primary sclerosing cholangitis, and mixed cirrhosis. Patients of varying cirrhosis and liver disease etiology can have their SPI measured at routine biannual US screening for HCC in the outpatient clinic.

- *Non-Invasive Laboratory Parameters Comparison between the Studied Arms*

The presence of EVs as well as the size distribution of EVs could be anticipated using APRI. The presence of EV could be predicted with a sensitivity of 68.8 percent and a specificity of 65 percent using APRI with a CO greater than 1.14, as shown by El attya et al. in 2019**.** agrees with research from Mattos et al. 2013 showing that APRI at a CO of 1.3 can predict the presence of EV with a sensitivity of 64.70 percent and a specificity of 72.70 percent.

Shehata et al. (2014) demonstrated that an APRI with a CO greater than 1.26 can predict the presence of EV with a sensitivity of 72.4% and a specificity of 61.9%.

Our results were in accordance with ***Badawi et al. 2020*** who situated that the AUCs of APRI for determining the presence of varices were 0.73 with CO value > 0.6 with a specificity of 60% and sensitivity was 80%. It is possible that this result is due to the fact that this study was conducted on cases that were treated for the DAAS virus, and the C virus was no longer active in these patients. As for the other studies, most of them were done on cases due to active C virus or for other reasons of fibrosis.

Our study showed that APRI was a predictable factor for the presence of large EV and showed that the AUC was 0.919 with a significant value higher in the large variceal arm than the small variceal arm, (P < 0.001) with the best CO to be >1.4, The sensitivity was (93.88%), specificity (80.95%), PPV (79.3%), NPV (94.4%).

FIB4 was a predictor for the presence of EVs as well as for the differentiation of large EVs. ***Ishida et al. 2020*** demonstrated that patients with cirrhosis and a FIB-4 2.78 are less likely to have high-risk varices and should undergo FIB-4 reassessment every 6–12 months; this study is consistent with our study of the presence or absence of EV**.**

***Ishida et al. 2020*** demonstrated that those with a FIB-4 2.78 should undergo endoscopic variceal screening**.**

Our study determined the CO of FIB4 for large varices 7.6. This result can be explained because this study was conducted on post-HCV patients after DAAS, unlike other studies that were conducted on patients suffering from active hepatitis C virus or from other causes of cirrhosis.

The mean ofChild–Pugh score in arm 1 was 6.0(5.0–6.0) while in arm 2was 6.0(6.0–7.50) and in arm 3 was 7.0(7.0–10.0) with a significant value among three arms in prediction of the presence of EV and significant in prediction of large varices with advanced score.

Non-variceal arm (GPI) I showed that Thirty Tree (86.8 %) had Child's class A liver disease, 5 (13.2%) had Child's class B disease while no patient had Child's class C disease Small variceal arm (GPII) showed 35 (55.6%) had Child's class A liver disease, 25(25%) had Child's class B disease while 3 (4.8%) patient had Child's class C disease. Large Variceal arm (GP III) showed 3(55.6 %) had Child's class A liver disease, 33(67.3%) had Child's class B disease, and 13 (26.5%) patients had Child's class C disease.

The prevalence of varices was found to be significantly higher in Child B and Child C patients compared to Child A patients, in Elatty et al. 2019 and Yosry et al.2009 studies. Large varices, fundal varices, congestive gastropathy, and signs of impending rupture of varices were significantly more prevalent in Child B and C patients than in Child A patients. These findings suggested that patients with Child B and C cirrhosis have a greater risk of developing varices and a greater risk of bleeding.***(.Sheta ET al, 2016).***

Similar to other reports from Western countries, our study revealed a significant correlation between variceal size and the severity of liver disease. In a meta-analysis, the values recorded in this study were greater than those reported by the North Italian Endoscopic Club for the study and treatment of EV. (NICE 1998). These findings were consistent with Said et al. (2010) and Tafarel et al. (2011), who reported that the size of EV increased as the Child's score increased. In addition, the Child score and the presence of EV were found to have a strong positive correlation. Child-Pugh scores of B and C were significantly correlated with EV, as determined by Kim et al. (2011).

## VII. CONCLUSIONS AND RECOMMENDATIONS

The AUC and diagnostic Accuracy for Platelet/splenic ratio was > SPI > FIB4> APRI > PVV > SI >Child–Pugh score for prediction EV in post-HCV liver cirrhotic patients after direct-acting antiviral drugs (DAAs).

The AUC and diagnostic Accuracy for SPI > Platelet/splenic ratio > APRI > FIB4 > SI > PVV >Child–Pugh score for Discrimination Large OV from in post-HCV liver cirrhotic patients after direct-acting antiviral drugs (DAAs).

**Conflicts of interest:** There are no conflicts of interest.

**Ethics statement:** The Helsinki Declaration on Human and Animal Rights, 1975 served as the basis for the research., as amended in 2000 and 2008, and the authors obeyed the policy regarding Informed Consent.

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