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Original Research Article

ACCURACY OF TWO-DIMENSIONAL SHEAR WAVE ELASTOGRAPHY FOR DIAGNOSING LIVER FIBROSIS IN PATIENTS WITH CHRONIC HEPATITIS C

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Abstract: *The prospective study was conducted in tertiary care hospitals from January 2021 to January 2022 to assess the diagnostic accuracy of two-dimensional shear wave elastography for evaluating liver fibrosis in patients with HCV by using liver biopsy and METAVIR staging as a diagnostic reference. Two hundred fifteen patients who fulfilled the study criteria were included. 2D SWE examination was done by two experienced radiologists, blinded to the clinical and histological data of the participants, independently. The METAVIR scoring system was used for staging liver fibrosis. Biochemical tests for serum liver fibrosis biomarkers were also performed. In addition to patients, 25 healthy controls were included. Results showed that SWE was successfully performed in 97.6% (210/215) cases. In the study group, the median SWV was 1.75 (0.95-2.86) m/s. In the control group, the median SWV was 1.29 (1.04-1.48) m/s. 30 patients had stage F0, 42 had F1, 30 had F2, 40 had F3 and 68 had F4. For necro inflammation, 9 patients had A0, 126 had A1, 71 had A2, and 4 had A3. For stenosis, 169 patients had S0, 35 had S1, 3 had S2 and 4 had S3. The higher fibrosis stages were positively correlated with increased SWV (P<.0001). There was a significant negative correlation between SWV and Alb and Plt and a significant positive correlation between SWV and M2BPGi, IV-c-7S, HA, PT, ALT, AST, and T.Bil. AUCs for 2D SWE were higher than serum biomarkers (P<0.05). In conclusion, 2D SWE has higher diagnostic accuracy than serum liver fibrosis biomarkers and is significantly associated with the severity of fibrosis.*

Keywords: Hepatitis C, Liver fibrosis, 2D Shear Wave Elastography

Introduction

The prognosis of chronic liver disease (CLD) depends upon the extent of liver fibrosis(Khatun and Ray, 2019). Severe fibrosis leads to cirrhosis, necessitates liver transplant, and causes mortality in patients with HCV (Indolfi et al., 2019). A liver biopsy is the gold standard for evaluating liver fibrosis (Moreno et al., 2019; Yang et al., 2021). However, a biopsy is associated with complications, including bleeding and sampling errors. A non-invasive quantitative evaluation of liver fibrosis is done by serum fibrotic biomarkers such as Mac 2 binding protein glycosylation isomer (M2BPGi), serum hyaluronic acid (HA) and type IV collagen 7S (IV-c-7S) (Anstee et al., 2022; Ezzat et al., 2022). Some studies have shown that indirect fibrosis scores like the Fibrosis-4 (FIB-4) index and aspartate aminotransferase (AST) to platelet ratio index (APRI) are helpful in the evaluation of liver fibrosis (Catanzaro et al., 2021).

Elastography is also a non-invasive technique for the assessment of liver fibrosis. The European Association for the Study of the Liver has recommended transient elastography (TE) for staging hepatic fibrosis (Panel et al., 2021). However, it has limited value for patients with ascites and obese patients. One-dimensional TE measurements have recently evolved into two-dimensional shear wave elastography (SWE). This study aims to assess the diagnostic accuracy of two-dimensional shear wave elastography for evaluating liver fibrosis in patients with HCV by using liver biopsy and METAVIR staging as diagnostic references.

Methodology

The prospective study was conducted in tertiary care hospitals from January 2021 to January 2022. Patients with HCV-associated chronic liver disease who underwent liver biopsy and 2D SWE at our hospital were included in the study. HCV-RNA polymerase reaction analysis was used to confirm HCV-associated CLD. Those with a history of alcohol abuse, hepatitis B infection, autoimmune hepatitis, and primary biliary cholangitis were excluded. After taking informed consent, two hundred fifteen patients who fulfilled the study criteria were included. The ethical committee of Nishtar Hospital approved the study.

2D SWE examination was done by two experienced radiologists, blinded to the clinical and histological data of the participants, independently. Ten separate liver stiffness measurements (LSM) were obtained. A liver biopsy was performed on the same day. 22mm sample was obtained using a 14 G biopsy needle. Samples were sent to a laboratory for processing and were examined by experienced radiologists. The METAVIR scoring system was used for staging liver fibrosis. Fibrosis was staged as F0 (absence of fibrosis), F1 (portal fibrosis), F2 (portal fibrosis with few septa), F3 (numerous septa), and F4 (cirrhosis).

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Necroinflammation was graded as: A0 (none), A1 (mild), A2 (moderate) and A3 (severe). Stenosis was classified as: S0 < 5%, S1=5to 33%, S2 =34 to 66% and S3 > 67%

Biochemical tests for serum liver fibrosis biomarkers, including total bilirubin, alanine aminotransferase (ALT), AST, albumin (Alb), platelet count (Plt), prothrombin time (PT), M2BPGi and HA, IV-c-7S were performed. FIB-4 index and APRI were calculated using age and hematological examination.

SPSS version 23.0 was used for data analysis. Data was presented as mean and standard deviation and as median. Categorical and continuous variables were compared using the Kruskal-Wallis test. Spearman's rank correlation coefficient was used for assessing the correlation between shear wave velocity and study variables. Accuracy of serum biomarkers and SWE was determined by sensitivity and specificity. Positive predictive value, negative predictive value, and diagnostic accuracy were measured. P value < 0.05 was considered statistically significant.

Results

The mean age of the participants was 65.75 ±10.8 years. The mean BMI was 23.65± 3.4 kg/m2. There were 140 males and 75 females. In addition to patients, 25 healthy controls were included. The mean age of the controls was 41.54± 11.1 years. There were 11 males and 14 females. SWE was successfully performed in 97.6% (210/215) cases. The failure in the remaining patients was the inability to hold their breath optimally. In the control group, the median IQR/median ratio was 0.040. The study group was 0.049, 0.51, 0.055, and 0.064 in the F0, F1, F2, F3, and F4 stages respectively.

30 patients had stage F0, 42 had F1, 30 had F2, 40 had F3 and 68 had F4. For necro inflammation, 9 patients had A0, 126 had A1, 71 had A2, and 4 had A3. For stenosis, 169 patients had S0, 35 had S1, 3 had S2 and 4 had S3.

In the control group, the median SWV was 1.29 (1.04-1.48) m/s. In the study group, the median SWV was 1.75 (0.95-2.86) m/s. In the F0, F1, F2, F3, and F4 stages, median SWVs were 1.45, 1.52, 1.68, 1.93, and 3.13, respectively. It shows that higher stages were positively correlated with an increase in SWV (P<.0001). SWV in patients with A2 was significantly higher than A1 and A0 (P < 0.01). The SWV for S0, S1, and S2 was 1.72, 1.79, and 1.59; this difference was insignificant.

There was significant correlation between SWV and M2BPGi (P < .001), IV-c-7S (P < .001), IV-c-7S (P < .001), Plt (P < .001), PT (P< .001), Alb (P< .001), ALT (P < .001), AST (P < .001) and T.Bil (P < .001).

The AUROC of SWE for diagnosing various stages of fibrosis is presented in Table I. AUCs for 2D SWE were higher compared to serum biomarkers (P<0.05) (Table II).

Table I: Parameters of 2D Shear wave elastography for F4, F3, F2 and F1

Parameters	F4	≥F3	≥F2	≥F1
The area under the curve	0.950	0.939	0.913	0.890
95% Confidence Interval	0.93-0.98	0.90-0.96	0.90-0.97	0.87-0.95
Optimal cutoff	1.929	1.719	1.559	1.478
Specificity	0.910	0.840	0.857	0.880
Sensitivity	0.916	0.890	0.855	0.760
Positive predictive value	0.809	0.845	0.916	0.976
Negative predictive value	0.959	0.885	0.765	0.387
Accuracy	0.909	0.890	0.856	0.810

Table II: AUC in various stages of fibrosis

Diagnostic tools	F4	≥F3	≥F2	≥F1
2D-shear wave elastography	0.950 (0.94-0.99)	0.941 (0.93-0.99)	0.917 (0.90-0.97)	0.890 (0.87-0.95)
Hyaluronic acid	0.857** (0.80-0.92)	0.829* (0.80-0.91)	0.755** (0.72-0.85)	0.708** (0.65-0.79)
IV Collagen 7S	0.870** (0.82-0.95)	0.850* (0.80-0.91)	0.783** (0.73-0.86)	0.715** (0.65-0.85)
M2BPGi	0.883** (0.85-0.95)	0.855* (0.81-0.92)	0.819** (0.78-0.90)	0.765** (0.70-0.85)
APRI	0.890** (0.86-0.95)	0.843* (0.80-0.90)	0.800** (0.75-0.87)	0.750** (0.70-0.83)
FIB-4 Index	0.896** (0.86-0.96)	0.857* (0.81-0.90)	0.815** (0.77-0.89)	0.753** (0.77-0.89)
***P<0.01, **P<0.05**				

Discussion

This study evaluated the diagnostic value of 2D shear wave elastography for liver fibrosis. The findings suggest that 2D-SWE can accurately diagnose liver fibrosis in patients with HCV. Optimal treatment and prognosis in HCV-related CLD depends upon correct evaluation of stages of liver fibrosis(Celli et al., 2021). Studies have proved the accuracy of different types of elastography in diagnosing liver fibrosis (de Souza Pires-Neto et al., 2020; Mak et al., 2020). A study showed that TE has good AUC values for predicting significant fibrosis and cirrhosis(Barr et al., 2020). Another study reported that Point SWE (pSWE) has comparable diagnostic accuracy as TE and can be used in patients with ascites, unlike TE(Herlihy et al., 2023). Studies show that in 2D SWE, AUC in patients with HCV was 0.914 and 0.907 in patients with advanced fibrosis. In the current study, the AUC for advanced fibrosis was 0.941 (95% CI 0.923-0.966)(Wei et al., 2020). 2D SWE had significantly higher diagnostic accuracy for different fibrosis stages than serum liver fibrosis biomarkers. As suggested by previous studies, elasticity measurements in 2DSWE are not affected by histopathological and clinical variables like steatosis and body mass index(Fu et al., 2020; Kumada et al., 2022).

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In patients with A2 necroinflammation, SWV was higher in patients with A1 and A0 necroinflammation. There was a significant negative correlation between SWV and Alb and Plt and a significant positive correlation between SWV and M2BPGi, IV-c-7S, HA, PT, ALT, AST, and T.Bil. There are several limitations of the current study. First, it had a small sample size. A larger prospective study is required to accurately quantify the 2D SWE threshold for diagnosing fibrosis. Second, Liver biopsy was done for staging of fibrosis, liver biopsy has the margin for sampling error. Third, patients with moderate to severe stenosis and obesity were not included in our study.

Conclusion

2D SWE has higher diagnostic accuracy than serum liver fibrosis biomarkers and is significantly associated with the severity of fibrosis.

Declarations

Data Availability statement
All data generated or analyzed during the study are included in the manuscript.
Ethics approval and consent to participate
Approved by the department Concerned.
Consent for publication
Approved
Funding
Not applicable

Conflict of interest

The authors declared absence of conflict of interest.

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