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(RESEARCH ARTICLE)

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Ultrasound evaluation of chronic liver disease

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Abstract

Background: About 296 million individuals worldwide suffer from chronic liver disease and hepatitis B virus (HBV) infection, which is the primary cause of cirrhosis and liver cancer worldwide. Chronic hepatitis B has become a serious public health concern in China. Non-alcoholic fatty liver disease, or NAFLD, is one of the main causes of cirrhosis worldwide. The National Health and Nutrition Examination Survey found that advanced fibrosis was present in up to 10.3% of NAFLD patients. These results imply that considerable fibrosis, severe fibrosis, and cirrhosis can be evaluated using real-time shear wave elastography (SWE).

Objective: To determine ultrasound evaluation of chronic liver disease

Methods: A cross-sectional study was conducted at Brooklyn Methodist hospital, ACE institute of technology New York, USA, which was performed between July 2022 and September 2024, The total patients in our study was 116. In 116 consecutive patients who underwent for ultrasound evaluation of chronic liver disease before their scheduled liver biopsy (58 men, 58 women). We used Michael Mindray ultrasound machine and its frequency was C6-1. The stages of liver fibrosis according to the METAVIR classification system. Data was tabulated and analyzed by SPSS version 27.

Results: According to our study total patients were 116, Distribution of patients according to gender was (58 were males and 58 were females). Distribution of patients according to mean age (out of 116 patients, 43.8983 were males and 47.9492 were females). Distribution of patients on the basis of Fatty Liver (n=116). Frequency of no fatty liver was 48 and its percentage was 41.5 %. Frequency of mild fatty liver was 39 and its percentage was 33.1 %. Frequency of moderate fatty liver was 8 and its percentage was 6.8 %. Frequency of sever fatty liver was 21 and its percentage was 18.6 %. Distribution of patients on the basis of Hepatitis B and Hepatitis C with respect to gender (n=116). Hepatitis B was present in male patients 57 (98.3%) and Hepatitis B was not present in male patients 1 (1.7%). Hepatitis B was present in female patients 57 (98.3%) and Hepatitis B was not present in female patients 1 (1.7%).

Hepatitis C was present in male patients 45 (78.0%) and Hepatitis C was not present in male patients 13 (22.0%). Hepatitis C was present in female patients 49 (84.7%) and Hepatitis C was not present in female patients 9 (15.3 %). P-value of stages of Liver fibrosis with respect to gender is 0.005.

Conclusion: Our result concluded that ultrasound is the first line of imaging modality to diagnose chronic liver disease. Liver fibrosis is more common in females as compared to males. According to the age males have higher risk as compare to females. Ultrasound is a straightforward, quick, and repeatable technique for noninvasively assessing of chronic liver disease. Benefits include its low cost and global availability.

Keywords: Ultrasound (USG); Liver fibrosis; Hepatitis B and Hepatitis C; Ultrasound shear wave elastography (SWE)

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1. Introduction

Chronic hepatitis B virus (HBV) infection affects about 296 million people worldwide and is the principal etiology of cirrhosis and liver cancer globally [1]. Chronic hepatitis B has become a significant public health concern in China [2]. The gold standard for diagnosing liver fibrosis or cirrhosis is now liver biopsy [3]. Nonalcoholic fatty liver disease (NAFLD) affects 20–30% of people in Western nations [4]. Liver biopsy is frequently used as the reference standard for staging fibrosis, a gauge of the severity of liver disease, and grading steatosis and inflammation, two features specific to steatohepatitis [5, 6]. Liver biopsies, however, are invasive procedures that include a risk of bleeding, pain, and obtaining an incorrect sample [7, 8]. Therefore, a noninvasive approach is needed to assess hepatic steatohepatitis. Hepatic fibrosis can lead to liver failure, cirrhosis, and cancer. There are numerous clinical therapeutic techniques available, depending on the severity of liver fibrosis [9]. An important development in the noninvasive detection of liver fibrosis is the development of elasticity-based ultrasonography (US) techniques, which measure the velocity of elastic shear waves to provide a numerical evaluation of liver stiffness [10–11]. It has shown good accuracy in detecting fibrosis, especially cirrhosis [12–13]. Even though liver stiffness and the severity of fibrosis are frequently closely related, elastography can only evaluate stiffness [14]. One type of fibrotic development that can enlarge to the size of the US wavelength is cirrhotic nodules [15].Non-alcoholic fatty liver disease (NAFLD) is one of the primary causes of cirrhosis worldwide [16], and it is also one of the top and fastest-growing causes of chronic liver disease globally, with obesity and insulin resistance coming in second and third, respectively [17, 18]. The National Health and Nutrition Examination Survey found that progressive fibrosis was present in up to 10.3% of NAFLD patients [19]. These findings suggest that cirrhosis, severe fibrosis, and considerable fibrosis may all be assessed using real-time SWE [20].

2. Materials and methods

A cross-sectional study was conducted at Brooklyn Methodist hospital, ACE institute of technology New York, USA, which was performed between July 2022 and September 2024, The total patients in our study was 116. In 116 consecutive patients who underwent for ultrasound evaluation of chronic liver disease before their scheduled liver biopsy (58 men, 58 women). We used Michael Mindray ultrasound machine and its frequency was C6-1. The stages of liver fibrosis according to the METAVIR classification system. Data was tabulated and analyzed by SPSS version 27.

3. Results

Table 1 Distribution of patients according to gender and mean age *(n=116)*

Variable	Frequency	Percentage
Gender:		
Male	58	100.0
Female	58	100.0
Total	116	100%
	Mean	SD
Age		
Male	43.8983	15.16
Female	47.9492	12.92
Total Age	45.92	13.71

According to our study total patients were 116, Distribution of patients according to gender was (58 were males and 58 were females). Distribution of patients according to mean age (out of 116 patients, 43.8983 were males and 47.9492 were females). Distribution of patients according to mean age of standard deviation (16.16 were males and 12.92 were females). Graphical Representation of gender represent that both gender are same in number 58 were males and 58 were females.

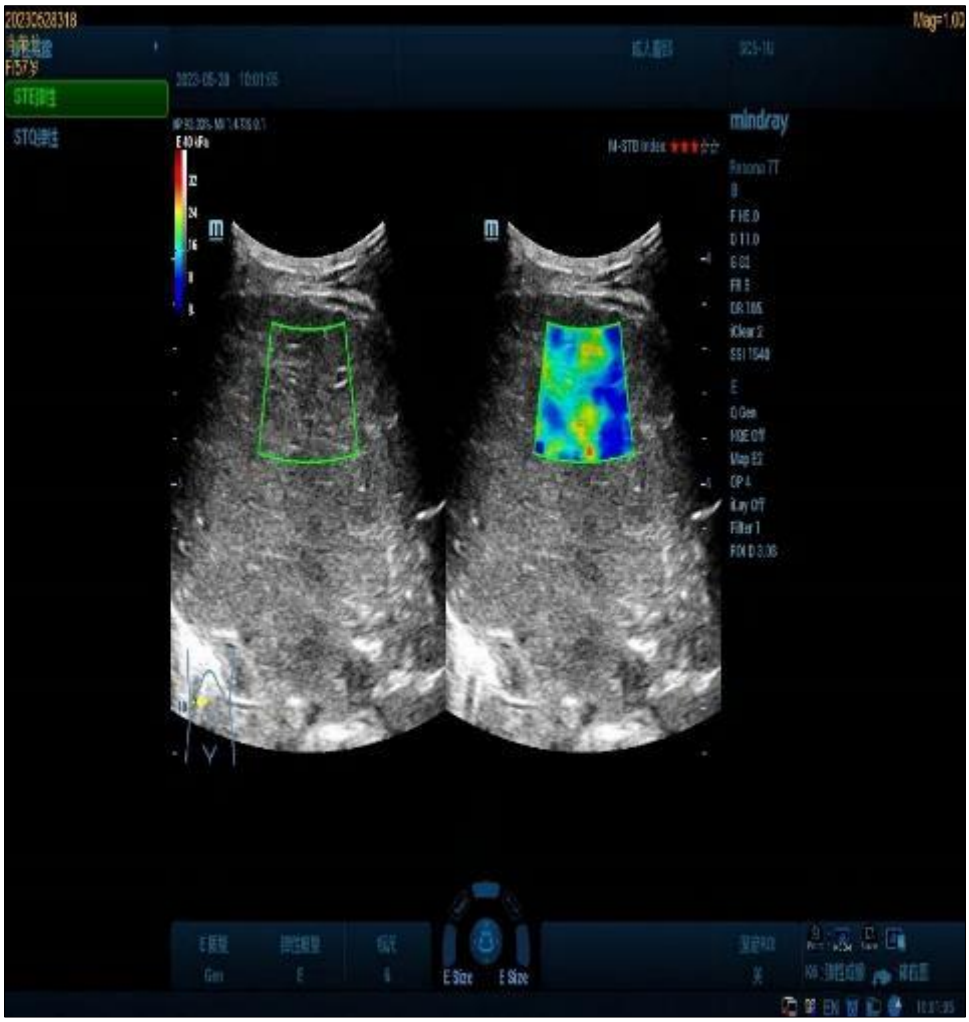

Figure 1 Cirrhosis or advanced scarring on ultrasound.

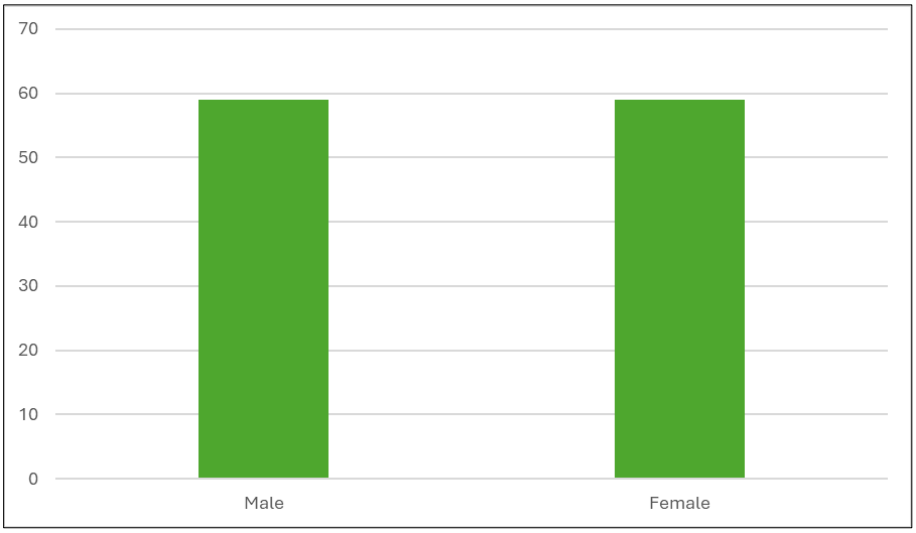

Figure 2 Graphical Representation of gender

Table 2 Mean and SD of enrolled patients (*n=116)*

Variables	MEAN±SD
ALT	91.6±116.14
AST	73.23±81.75
ALP	301.46±989.9
TBIL	54.03±203.98
DBIL	7.27±21.3
GGT	171.80±721.1
CNE	4928.51±2187.2
BUN	42.59±31.5

Mean and Standard Deviation (SD) of liver Function

MEAN±SD of bilirubin test (DBIL) was 7.28±21.3 umol/L, MEAN±SD of gamma-glutamyl transferase (GGT) was 171.80±711.1 u/L, MEAN±SD of creatine kinase (CNE) was 4928.51±2287.2 u/L, MEAN±SD of blood nitrogen urea (BUN) was 42.59±31.5 mmol/L, MEAN±SD of ALT was 91.6±116.14 u/L, MEAN±SD of aspartate aminotransferase (AST) was 73.23±81.75 u/L, and MEAN±SD of alkaline phosphate (ALP) was 301.46±999.98 umol/L.

Table 3 The stages of fibrosis according to the METAVIR classification system *(n=118)*

Stages of fibrosis	Frequency	Percentage
F0	33	28.0
F1	5	4.2
F2	57	49.2
F3	9	7.6
F4	12	11.0

- F0= no portal fibrosis;
- F1= perisinusoidal or portal/periportal fibrosis;
- F2= both perisinusoidal and portal/periportal fibrosis;
- F3= bridging fibrosis;
- F4= cirrhosis.
- The stages of Liver fibrosis according to the METAVIR classification system *(n=118),*
- The frequency of patients with F0 was 33 (28.0 %), The frequency of patients with F1 was 5 (4.2%)
- The frequency of patients with F2 was 57 (49.2%), The frequency of patients with F3 was 9 (7.6%)
- The frequency of patients with F4 was 12 (11.0%)
- In the above pie graph F2: 49%, F0: 28%, F4: 11%, F3: 8% and F1: 4 %.

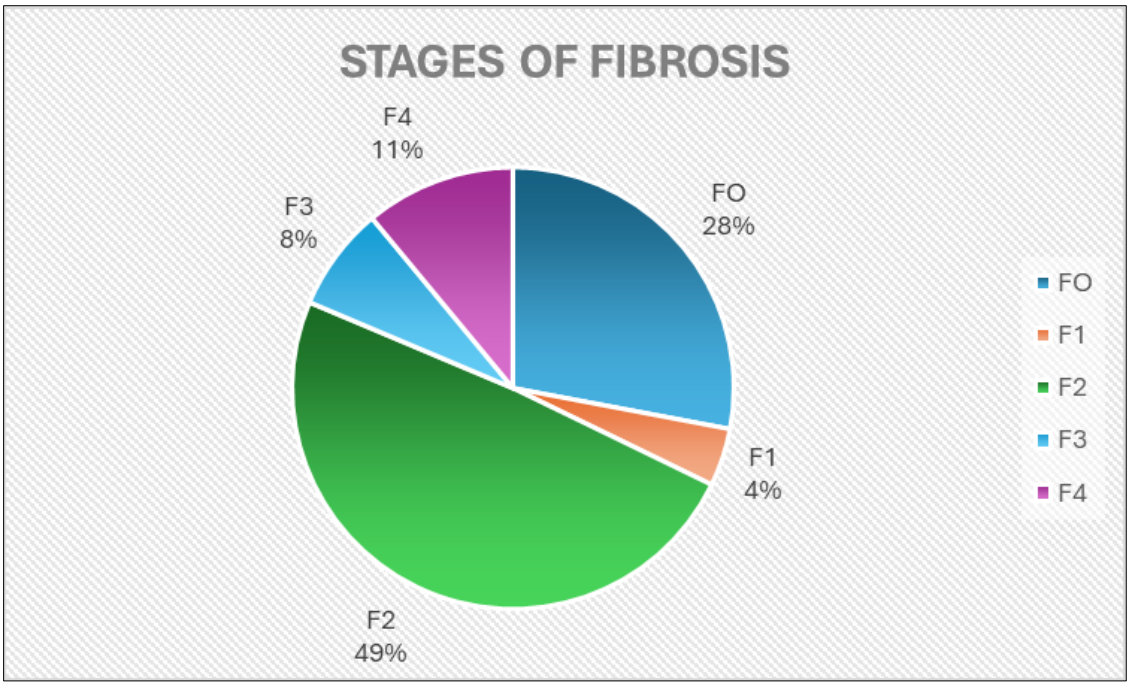

Figure 3 Stages of Fibrosis

Table 4 Distribution of patients on the basis of Fatty Liver (*n=116)*

Fatty liver	Frequency	Percentage
No	48	41.5
Mild	39	33.1
Moderate	8	6.8
Severe	21	18.6
Total	116	100.0

Distribution of patients on the basis of Fatty Liver (n=116). Frequency of no fatty liver was 48 and its percentage was 41.5 %. Frequency of mild fatty liver was 39 and its percentage was 33.1 %. Frequency of moderate fatty liver was 8 and its percentage was 6.8 %. Frequency of sever fatty liver was 21 and its percentage was 18.6 %.

Table 5 Distribution of patients on the basis of Hep B and Hep C (*n=116)*

Hepatitis	Frequency	Percentage
Hep B		
YES	95	81.4
NO	21	18.6
Hep C		
YES	114	98.3
NO	2	1.7

Hep= Hepatitis

3.1. Distribution of patients on the basis of hepatitis B and hepatitis C (n=116)

Hepatitis B was present in 95 patients out of 118 (81.4%), Hepatitis B was not present in 21 patients out of 118 (18.6). Hepatitis C was present in 114 patients out of 116 (98.3%), Hepatitis C was not present in 2 patients out of 116 (1.7).

Table 6 Distribution of patients on the basis of Hep B and Hep C with respect to gender (*n=116)*

		Hepatitis B	
Gender	Frequency	Percentage	P-Value
MALE			0.33 Not significant
YES	57	98.3	
N0	1	1.7	
FEMALE			
YES	57	98.3	
NO	1	1.7	
	Hepatitis C		
Male			1.0 Not significant
YES	45	78.0	
NO	13	22.0	
Female			
YES	49	84.7	
NO	9	15.3	

Distribution of patients on the basis of Hepatitis B and Hepatitis C with respect to gender (n=116). Hepatitis B was present in male patients 57 (98.3%) and Hepatitis B was not present in male patients 1 (1.7%). Hepatitis B was present in female patients 57 (98.3%) and Hepatitis B was not present in female patients 1 (1.7%).

P-value of hepatitis B is 0.34.

Hepatitis C was present in male patients 45 (78.0%) and Hepatitis C was not present in male patients 13 (22.0%). Hepatitis C was present in female patients 49 (84.7%) and Hepatitis C was not present in female patients 9 (15.3 %).

P-value of hepatitis C is 1.0

Table 7 Distribution of patients on the basis of Stages of fibrosis with respect to gender (*n=116)*

		Stages of fibrosis	
Gender	**Frequency**	**Percentage**	**P-Value**
MALE			0.05 significant
F0	24	42.4	
F1	1	1.7	
F2	25	44.1	
F3	2	3.4	
F4	5	8.5	
FEMALE			
F0	8	13.6	
F1	4	6.8	
F2	31	54.2	

F3	7	11.9	
F4	8	13.6	

Distribution of patients on the basis of Stages of Liver fibrosis with respect to gender (*n=116).* Frequency of F0 in male Patients was 24 (42.4%), Frequency of F1 in male Patients was 1 (1.7%), Frequency of F2 in male Patients was 25 (44.1%), Frequency of F3 in male Patients was 2 (3.4%), Frequency of F4 in male Patients was 5 (8.5%).

Frequency of F0 in female Patients was 8 (13.6%), Frequency of F1 in female Patients was 4 (6.8%), Frequency of F2 in female Patients was 31 (54.2%), Frequency of F3 in female Patients was 7 (11.9%), Frequency of F4 in female Patients was 8 (13.6%).

Table 8 Patient characteristics of enrolled patients (n=116)

Variables	**Frequency**	**Percentage**	**P-Value**
Jaundice			
NO	45	38.5	
YES	71	60.7	0.04
Alcohol use			
NO	38	32.5	
YES	78	66.7	
Chronic Liver disease diagnosed on			
Ultrasound	111	94.9	
Ultrasound +CT Scan	5	4.3	

The frequency of jaundice were not present in 45 patients and were present in 71 patients and its percentage were 60. The p-value were 0.04.

The frequency of alcohol use were not present in 38 patients and were present in 78 patients. The frequency of chronic liver disease diagnose on ultrasound were 111 and chronic liver disease whose were diagnose on ultrasound and CT scan were 5 patients.

4. Discussion

In this study, Histology and real-time shear wave elastography (SWE) were compared for diagnostic accuracy in determining liver fibrosis. According to these results, cirrhosis, severe fibrosis, and substantial fibrosis may all be evaluated using real-time SWE [20]. For the diagnosis of liver fibrosis, pathological analysis of hepatic wound tissue is still necessary. Due to its intrusive nature, the approach's general use in clinical practice is currently limited. Much focus has been paid to the creation of a non-invasive diagnostic marker for liver fibrosis [21]. Using liver biopsy as the standard of reference, we assessed the optimal region to take measurements from and calculated the diagnostic accuracy of SWE for liver fibrosis estimation in patients with hepatitis C virus (HCV) and chronic liver disease (CLD) in this prospective cross-sectional study [22]. The accurate and non-invasive classification of liver fibrosis is crucial in clinical practice. A deep learning method for staging liver fibrosis using ultrasonic shear wave elastography was recently reported, and it worked effectively [23]. According to histopathology, the liver's excessive buildup of extracellular matrix components results in hepatic fibrosis. This process, which can lead to cirrhosis, is brought on by the body's wound-healing reaction to chronic liver damage. It involves the activation of hepatic stellate cells, the creation of high alpha smooth muscle actin, and the secretion of collagen types I and III [24]. Excessive extracellular matrix buildup after injury causes liver fibrosis, which is the primary cause of cirrhosis, malignancy, and mortality. which are the leading causes of death worldwide [25, 26]. Because imaging provides considerably crisper views of the anatomical and spatial distribution of the probe, it is possible to compile enough precise information on the overall levels of probe accumulation in the tissue or organ of interest [27].

5. Conclusion

Our result concluded that ultrasound is the first line of imaging modality to diagnose chronic liver disease. Liver fibrosis is more common in females as compared to males. According to the age males have higher risk as compare to females. Ultrasound is a straightforward, quick, and repeatable technique for noninvasively assessing of chronic liver disease. Benefits include its low cost and global availability.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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