ROLE OF THE FIBROSCAN IN ASSESSING CHRONIC LIVER DISEASES

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ABSTRACT

Background

Chronic liver disease (CLD) is a long-term inflammatory process of the liver parenchyma. In 2017 it was estimated that 1.5 billion persons had CLD, ranging from most to least common aetiology NAFLD (60%), HBV (29%), HCV (9%), and ALD (2%). The gold standard test for confirming the diagnosis, staging fibrosis, grading activity, and judging response to treatment in CLD is Liver biopsy. However, it has several limitations; as a result, validated noninvasive tests are required. Transient elastography (FibroScan; Echosens, Paris, France) is a new, non-invasive technique for measuring liver stiffness.

Objectives

The aims of the study: To determine the role of Fibroscan in assessing fibrosis and steatosis among a group of patients with chronic liver diseases and compare Fibroscan with other noninvasive methods (APRI, NFS and FIB-4).

Patients and Methods

This cross-sectional study was conducted on 100 patients with chronic liver disease at Kurdistan Centre for Gastroenterology and Hepatology (KCGH). Fibroscan was done in an outpatient clinic in Sulaimaniyah from June 2019- November 2020. Required data were collected from the patients based on their Clinical, laboratory and radiological findings. The collected data were analysed using Statistical Package for the Social Sciences (SPSS version 25.0).

Results

Fifty-nine percent of the patients were males. Causes of CLD among patients were as follows: 58% had hepatitis B virus infection, 18% had hepatitis C virus infection, 16% had nonalcoholic fatty liver disease, 4% had nonalcoholic steatohepatitis, 2% had alcoholic hepatitis, 1% had autoimmune hepatitis, 1% cryptogenic chronic hepatitis. The results revealed a significant association between the results obtained from Fibroscan and FIB-4 (p-value=0.001) and APRI (p-value=0.001). Moreover, the sensitivity and specificity of Fibroscan to FIB-4 were 91.2% and 26.7%, and to APRI were 82.4% and 20%.

Conclusion

There was a significant correlation between Fibroscan and FIB-4, APRI. The degree of fibrosis by Fibroscan had a significant association with platelet (PLT) count, alkaline phosphatase (ALP) and serum albumin. There was a significant association between steatosis grades and incidence of HBV, HCV, NAFLD, NASH and, alcoholic hepatitis.

Keywords: *Fibroscan, Transient elastography, Chronic liver disease, APRI, FIB-4.*

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INTRODUCTION

Chronic liver disease (CLD) is a long-term inflammatory process of the liver parenchyma in which hepatic necrosis and inflammation persist for at least six months. Globally, in 2017 it has been estimated that 1.5 billion persons had CLD, ranging from most to least common aetiology non-alcoholic fatty liver disease (NAFLD) (60%), chronic hepatitis B (CHB) (29%), chronic hepatitis C (CHC) (9%), and alcoholic liver disease (ALD) (2%). Among all death worldwide, 3.5% have been caused by major complications of CLD, including cirrhosis (1.2 million deaths) and liver cancer (790,000 deaths). The epidemiology of CLD is changing as a result of large-scale hepatitis B vaccine, hepatitis C treatment services, rising metabolic syndrome incidence, and alcohol abuse [1].

Cirrhosis is the last stage of chronic liver disease, characterised by the destruction of liver architecture, the development of widespread nodules, vascular reorganisation, neo-angiogenesis, and extracellular matrix deposition. The recruitment of stellate cells and fibroblasts, which results in fibrosis, is the underlying mechanism of fibrosis and cirrhosis at the cellular level. Patients with cirrhosis experience at least one decompensating event annually, with ascites, variceal haemorrhage, and hepatic encephalopathy being the most common [1, 2].

The gold standard test for confirming the diagnosis, staging fibrosis, grading activity, and judging response to treatment in CLD is Liver biopsy. However, it has several limitations, including patient discomfort, cost, difficulty performing the procedure in obese patients, sampling bias, procedure-related complications (like bleeding), and possibly death [3].

As a result, validated noninvasive tests are required to reliably represent the full range of hepatic fibrosis, cirrhosis, and its severity in liver diseases. Transient elastography (FibroScan; Echosens, Paris, France) is a new, non-invasive technique for measuring liver stiffness. The Function of Fibroscan depends on vibration-controlled transient elastography (VCTE, also known as 'transient elastography') in which a vibration from the vibrator of mild amplitude and low frequency is transmitted to the tissue. This vibration causes the tissue to vibrate, causing an elastic shear wave to spread. Meanwhile, pulse-echo ultrasonic acquisitions are carried out to track the shear wave's spreading and measure its velocity, which is directly related to tissue stiffness. The shear wave propagates more quickly in harder tissues (4).

APRI score: It is calculated in the following way: APRI = [AST level (/ULN)/Platelet counts (109/L)] × 100 and is one of the simplest marker panels that can diagnose significant fibrosis and cirrhosis with acceptable accuracy [5].

FIB-4: This is a combination of four simple variables: AST, ALT, age, and platelet count. The following formula is used to calculate it:

The FIB-4 index = [age (years) × AST (IU/L)]/ [platelet count (109/L) × ALT (IU/L)]1/2 [6].

PATIENTS AND METHODS

This is a cross sectional study; 100 cases were collected from Kurdistan Centre for Gastroenterology and Hepatology (KCGH) and Fibroscan done in an outpatient clinic (because it is not available in general hospital). This study has been performed in Sulaimaniyah from June 2019 to November 2020.

The study sample consisted of all patients who had liver disease for more than 6 months and had fasted for more than 3 hours before examining by Fibroscan. They were diagnosed as chronic liver disease based on their clinical, laboratory and radiological findings. We excluded any case of acute on chronic hepatitis, high ALT level (more than 100 IU/L), and any patients with heart failure.

Noninvasive serum fibrosis models calculation

Blood samples were obtained, and laboratory tests were performed including complete blood count (CBC), aspartate aminotransferase (AST), alanine aminotransferase (ALT), alkaline phosphatase (ALP), serum albumin, prothrombin time (PT), total serum bilirubin (TSB), and fibrosis panel calculated including AST to platelet ratio index (APRI), and fibrosis index based on 4 factors (FIB-4).

Liver stiffness was measured by using the Fibroscan device (Echosens, Paris, France). The patients were asked to lie on their back in the dorsal decubitus position with their right arm behind their head in maximal abduction. In some cases, it was useful to shift the patients' legs to the left to make intercostal space wider. Then, the xiphoid process was localized below the sternum, and then a line was drawn to reach the mid-axillary line. After the selection of the proper

probe, the median value of 10 successful shots was taken with an IQR of less than 30%.

Ethical considerations were taken into account by obtaining the approval of the study protocol from the university and written informed consent from the patients. The patients were also provided with sufficient information about their study's aim and duration.

Statistical analysis: Data were analyzed through the Statistical Package for the Social Sciences (SPSS version 25.0). For this purpose, descriptive and inferential statistical tests were utilized. All evaluations had a p-value of 0.05 as the threshold for statistical significance.

RESULTS

Total number of cases in our study was 100 cases. The mean age was 41.81±15.95. Fifty-nine percent of the patients were males and 41% females. In terms of their jobs, it was seen that 34% had governmental jobs, 33% were housewives, 23% had non-governmental jobs, and 10% were students. In terms of age group, half of them (50%) aged 25 to 50 years, Table-1. According to the results, 58% of the patients had hepatitis B virus (HBV), while only 18% had hepatitis C virus (HCV) disease, (NAFLD) was found in (16%), and 4% have nonalcoholic steatohepatitis (NASH). Moreover, only 2 patients (2%) had alcoholic hepatitis, 1 (1%) had autoimmune hepatitis, and (1%) had Cryptogenic chronic hepatitis, Table-2. According to the fibrosis scores, 34% of the patients did not have liver fibrosis(F0), 37% had mild to moderate liver fibrosis (F1-F2), 14% had advanced liver fibrosis (F3), and 15% had cirrhosis (F4). Steatosis grade (S) in 43% was S0, 16% was S1, 23% was S2, and 18% was S3. According to the aspartate aminotransferase (AST) to platelet ratio index (APRI), only 3% had cirrhosis. By calculating FIB-4 scores, advanced fibrosis was found in 4% of patients, (Table-3). Results from our study demonstrate that among all patients, 7% have thrombocytopenia (<150,000 PLT/microliter), 13% have high ALP level (>140 U/L) and 9% have hypoalbuminemia (<3.5 g/dl). Results of Fibroscan had significant association with platelet (PLT) count (p-value=0.001), alkaline phosphatase (ALP) (p-value=0.001), and serum albumin (p-value=0.01), Table-4. According to the obtained results, the Fibroscan were significantly associated with the patients' age (p-value=0.01), presenting symptom (p-value=0.01), past medical history (p-value=0.001), and examination results (p-value=0.02), Table-5. The results also indicated that results of Fibroscan had a significant association with alcoholic hepatitis (p-value=0.04), and autoimmune hepatitis (p-value=0.04), but no association was found with HBV, HCV, NAFLD, and NASH, Table-6. There was a significant association between the results obtained from Fibroscan and FIB-4 (p-value=0.001), APRI (p-value=0.001). Moreover, the sensitivity and specificity of Fibroscan to FIB-4 were 91.2% and 26.7%, to APRI were 82.4% and 20%, respectively, Table 7. According to the obtained results, a significant association was observed between steatosis grades and the patients' age, hepatitis B virus (HBV), (HCV), NAFLD, NASH, alcoholic hepatitis, BMI, and ultrasonography results (p-value<0.05), Table-8.

Table 1. The patients' demographics data.

	Frequency (N)	Percentage (%)
Gender		
Male	59	59.0
Female	41	41.0
Total	100	100.0
Occupation		
Governmental	34	34.0
Non-Governmental	23	23.0
Housewife	33	33.0
Student	10	10.0
Total	100	100.0
Age group		
< 25 years	18	18.0
25 – 50 years	50	50.0
> 50 years	32	32.0
Total	**100**	**100.0**

Table 2. Etiologies of CLD.

	Frequency (N)	Percentage (%)
HBV		
Positive	58	58.0
Negative	42	42.0
Total	100	100.0
HCV		
Positive	18	18.0
Negative	82	82.0
Total	100	100.0
NAFLD		
Positive	16	16.0
Negative	84	84.0
Total	100	100.0
NASH		
Positive	4	4.0
Negative	96	96.0
Total	100	100.0
Alcoholic Hepatitis		
Positive	2	2.0
Negative	98	98.0
Total	100	100.0
Autoimmune Hepatitis		
Positive	1	1.0
Negative	99	99.0
Total	100	100.0
Cryptogenic chronic hepatitis		
Positive	1	1.0
Negative	99	99.0
Total	**100**	**100.0**

Table 3. Fibroscan results and other noninvasive parameters.

	Frequency (N)	Percentage (%)
Fibroscan (F)		
F0	34	34.0
F1 - F2	37	37.0
F3	14	14.0
F4	15	15.0
Total	100	100.0
Steatosis (S)		
S0	43	43.0
S1	16	16.0
S2	23	23.0
S3	18	18.0
Total	100	100.0
APRI score		
No-cirrhosis	79	79.0
Indeterminate	18	18.0
Cirrhosis	3	3.0
Total	100	100.0
FIB-4 score		
<1.45 Normal	80	80.0
1.45 – 3.25 indeterminate score	16	16.0
>3.25 advanced fibrosis	4	4.0
Total	**100**	**100.0**

Table 4. Association between the results of Fibroscan and other tests.

	Fibroscan	Mean±SD	95% CI	P-value
PLT	F0	261.97±75.64	235.58–288.36	
	F1 - F2	260.68±68.10	237.97–283.38	
	F3	269.29±68.36	229.82–308.76	**0.001**
	F4	169.73±84.44	122.97–216.50	
	Total	248.68±79.59	232.89–264.47	
ALP	F0	105.21±51.73	87.16–123.25	
	F1 - F2	113.68±51.29	96.58–130.78	
	F3	110.00±33.35	90.74–129.26	**0.001**
	F4	208.40±212.02	90.99–325.82	
	Total	124.49±98.08	105.03–143.95	
Serum Albumin	F0	3.99±0.32	3.88–4.10	
	F1 - F2	4.19±0.41	4.05–4.33	
	F3	4.15±0.49	3.87–4.43	**0.01**
	F4	3.74±0.68	3.37–4.12	
	Total	4.05±0.47	3.96–4.14	

Table 5. Relation of Fibroscan with the patients' demographic and medical characteristics.

		Fibroscan				Total	P-value
		F0	F1 - F2	F3	F4		
Age group(year)	< 25	13(38.2)	2(5.4)	2(14.3)	1(6.7)	18(18.0)	**0.01**
	25 – 50	16(47.1)	19(51.4)	8(57.1)	7(46.7)	50(50.0)	
	> 50	5(14.7)	16(43.2)	4(28.6)	7(46.7)	32(32.0)	
Total		34(100.0)	37(100.0)	14(100.0)	15(100.0)	100(100.0)	
Gender	Male	20(58.8)	22(59.5)	6(42.9)	11(73.3)	59(59.0)	
	Female	14(41.2)	15(40.5)	8(57.1)	4(26.7)	41(41.0)	**0.43**
Total		34(100.0)	37(100.0)	14(100.0)	15(100.0)	100(100.0)	
Presenting Symptom of CLD	No	32(94.1)	36(97.3)	13(92.9)	10(66.7)	91(91.0)	
	Yes	2(5.9)	1(2.7)	1(7.1)	5(33.3)	9(9.0)	**0.01**
Total		34(100.0)	37(100.0)	14(100.0)	15(100.0)	100(100.0)	
Past Medical History	No	33(97.1)	32(86.5)	9(64.3)	12(80.0)	86(86.0)	
	DM	0(0.0)	4(10.8)	0(0.0)	0(0.0)	4(4.0)	
	HTN	1(2.9)	1(2.7)	2(14.3)	1(6.7)	5(5.0)	**0.001**
	Other	0(0.0)	0(0.0)	3(21.4)	2(13.3)	5(5.0)	
Total		34(100.0)	37(100.0)	14(100.0)	15(100.0)	100(100.0)	
Past Surgical History	Yes	21(61.8)	19(51.4)	9(64.3)	4(26.7)	53(53.0)	
	No	13(38.2)	18(48.6)	5(35.7)	11(73.3)	47(47.0)	**0.11**
Total		34(100.0)	37(100.0)	14(100.0)	15(100.0)	100(100.0)	
Alcohol use	Yes	0(0.0)	1(2.7)	1(7.1)	2(13.3)	4(4.0)	
	No	34(100.0)	36(97.3)	13(92.9)	13(86.7)	96(96.0)	**0.10**
Total		34(100.0)	37(100.0)	14(100.0)	15(100.0)	100(100.0)	
Family History of liver disease	Yes	5(14.7)	6(16.2)	1(7.1)	1(6.7)	13(13.0)	
	No	29(85.3)	31(83.8)	13(92.9)	14(93.3)	87(87.0)	**0.86**
Total		34(100.0)	37(100.0)	14(100.0)	15(100.0)	100(100.0)	
Examination findings of CLD	Yes	0(0.0)	1(2.7)	1(7.1)	3(20.0)	5(5.0)	
	No	34(00.0)	36(97.3)	13(92.9)	12(80.0)	95(95.0)	**0.02**
Total		34(100.0)	37(100.0)	14(100.0)	15(100.0)	100(100.0)	

Table 6. Correlations between Fibroscan and different etiologies.

		Fibroscan				Total	P-value
		F0	F1 - F2	F3	F4		
HBV	Positive	25(73.5)	19(51.4)	7(50.0)	7(46.7)	58(58.0)	**0.16**
	Negative	9(26.5)	18(48.6)	7(50.0)	8(53.3)	42(42.0)	
HCV	Positive	4(11.8)	7(18.9)	4(28.6)	3(20.0)	18(18.0)	**0.50**
	Negative	30(88.2)	30(81.1)	10(71.4)	12(80.0)	82(82.0)	
NAFLD	Positive	4(11.8)	9(24.3)	1(7.1)	2(13.3)	16(16.0)	**0.42**
	Negative	30(88.2)	28(75.7)	13(92.9)	13(86.7)	84(84.0)	
NASH	Positive	0(0.0)	2(5.4)	2(14.3)	0(0.0)	4(4.0)	**0.13**
	Negative	34(100.0)	35(94.6)	12(85.7)	15(100.0)	96(96.0)	
Alcoholic Hepatitis	Positive	0(0.0)	0(0.0)	0(0.0)	2(13.3)	2(2.0)	**0.04**
	Negative	34(100.0)	37(100.0)	14(100.0)	13(86.7)	98(98.0)	
AIH	Positive	1(2.9)	0(0.0)	0(0.0)	0(0.0)	1(1.0)	**0.04**
	Negative	33(97.1)	37(100.0)	14(100.0)	15(100.0)	99(99.0)	

Table 7. Association between the results of Fibroscan and other noninvasive methods.

Noninvasive methods for assessing liver fibrosis		Fibroscan				Total	P-value
		F0	F1 - F2	F3	F4		
FIB-4	<1.45 Normal	31(91.2)	31(83.8)	13(92.9)	5(33.3)	80(80.0)	**0.001**
	1.45 - 3.25 indeterminate score	3(8.8)	6(16.2)	1(7.1)	6(40.0)	16(16.0)	
	>3.25 advanced fibrosis	0(0.0)	0(0.0)	0(0.0)	4(26.7)	4(4.0)	
Total		34(100.0)	37(100.0)	14(100.0)	15(100.0)	100(100.0)	
APRI	No-cirrhosis	28(82.4)	33(89.2)	12(85.7)	6(40.0)	79(79.0)	**0.001**
	Not determinant	6(17.6)	4(10.8)	2(14.3)	6(40.0)	18(18.0)	
	Cirrhosis	0(0.0)	0(0.0)	0(0.0)	3(20.0)	3(3.0)	
Total		34(100.0)	37(100.0)	14(100.0)	15(100.0)	100(100.0)	

Table 8. Association between steatosis grades and the studied variables.

		S					
		S0	**S1**	**S2**	**S3**	**Total**	**P-value**
Age group(year)	< 25	14(32.6)	2(12.5)	2(8.7)	0(0.0)	18(18.0)	
	25 – 50	20(46.5)	8(50.0)	11(47.8)	11(61.1)	50(50.0)	**0.04**
	> 50	9(20.9)	6(37.5)	10(43.5)	7(38.9)	32(32.0)	
Total		43(100.0)	16(100.0)	23(100.0)	18(100.0)	100(100.0)	
Gender	Male	24(55.8)	14(87.5)	11(47.8)	10(55.6)	59(59.0)	
	Female	19(44.2)	2(12.5)	12(52.2)	8(44.4)	41(41.0)	**0.08**
Total		43(100.0)	16(100.0)	23(100.0)	18(100.0)	100(100.0)	
Alcohol use	Yes	1(2.3)	2(12.5)	0(0.0)	1(5.6)	4(4.0)	
	No	42(97.7)	14(87.5)	23(100.0)	17(94.4)	96(96.0)	**0.16**
Total		43(100.0)	16(100.0)	23(100.0)	18(100.0)	100(100.0)	
Family History of liver disease	Yes	3(7.0)	2(12.5)	4(17.4)	4(22.2)	13(13.0)	
	No	40(93.0)	14(87.5)	19(82.6)	14(77.8)	87(87.0)	**0.34**
Total		43(100.0)	16(100.0)	23(100.0)	18(100.0)	100(100.0)	
HBV	Positive	31(72.1)	6(37.5)	16(69.6)	5(27.8)	58(58.0)	
	Negative	12(27.9)	10(62.5)	7(30.4)	13(72.2)	42(42.0)	**0.001**
Total		43(100.0)	16(100.0)	23(100.0)	18(100.0)	100(100.0)	
HCV	Positive	9(20.9)	7(43.8)	1(4.3)	1(5.6)	18(18.0)	
	Negative	34(79.1)	9(56.3)	22(95.7)	17(94.4)	82(82.0)	**0.01**
Total		43(100.0)	16(100.0)	23(100.0)	18(100.0)	100(100.0)	
NAFLD	Positive	2(4.7)	1(6.3)	4(17.4)	9(50.0)	16(16.0)	
	Negative	41(95.3)	15(93.8)	19(82.6)	9(50.0)	84(84.0)	**0.001**
Total		43(100.0)	16(100.0)	23(100.0)	18(100.0)	100(100.0)	
NASH	Positive	0(0.0)	0(0.0)	1(4.3)	3(16.7)	4(4.0)	
	Negative	43(100.0)	16(100.0)	22(95.7)	15(83.3)	96(96.0)	**0.02**
Total		43(100.0)	16(100.0)	23(100.0)	18(100.0)	100(100.0)	
Alcoholic Hepatitis	Positive	0(0.0)	2(12.5)	0(0.0)	0(0.0)	2(2.0)	
	Negative	43(100.0)	14(87.5)	23(100.0)	18(100.0)	98(98.0)	**0.02**
Total		43(100.0)	16(100.0)	23(100.0)	18(100.0)	100(100.0)	
BMI	18.5 to 24.9	18(41.9)	4(25.0)	4(17.4)	2(11.1)	28(28.0)	
	25 to 29.9	15(34.9)	10(62.5)	12(52.2)	5(27.8)	42(42.0)	**0.01**
	30 or more	10(23.3)	2(12.5)	7(30.4)	11(61.1)	30(30.0)	
Total		43(100.0)	16(100.0)	23(100.0)	18(100.0)	100(100.0)	
Ultrasonography	Normal	37(86.0)	11(68.8)	16(69.6)	6(33.3)	70(70.0)	
	Abnormal	6(14.0)	5(31.3)	7(30.4)	12(66.7)	30(30.0)	**0.001**
Total		43(100.0)	16(100.0)	23(100.0)	18(100.0)	100(100.0)	

DISCUSSION

In the present study, Fibroscan results are significantly associated with the patients' age (p-value=0.01). The possible mechanisms behind the high prevalence of chronic liver disease in elderly patients are decreased liver regeneration capacity and diminished stress tolerance of hepatocytes [7, 8].

According to our results, most of the patients (91%) did not have any symptoms. Chronic liver diseases usually do not present with any symptoms and often undiagnosed, it is estimated that about 50% of patients with chronic liver disease are not aware of their status. So, approximately 44% of patients have cirrhosis when first presenting to a specialized gastroenterological clinic [9-11].

The result from the present study demonstrate causes of chronic liver disease as follows: 58% of the patients had HBV infection, 18% had HCV infection, 16% had NAFLD, 4% had NASH only 2 patients (2%) had alcoholic hepatitis, 1 (1%) had autoimmune hepatitis, and 1 (1%) had cryptogenic chronic hepatitis.

In the middle east, the major cause of cirrhosis related deaths is still hepatitis B, and although there are nationwide infant vaccination programs for hepatitis B in most countries in these regions none have been in place for more than 30 years. As it is obvious most of the mortality of hepatitis B is in patients older than 40 years, so hepatitis B is expected to remain a major cause of cirrhosis death for another decade or two, even in countries with good vaccine coverage [12].

The results of the present study revealed that 59% of the patients were males. The Possible explanation could be that estrogen may have a protective role against fibrosis in viral hepatitis by inhibiting stellate cells, which are responsible for fibrogenesis in the liver while potentiates fibrosis in alcoholic liver disease. Men and women are affected by HBV infection similarly. However, male sex is a risk factor for reactivation of HBV infection and the development of cirrhosis and HCC [13].

According to our study, there was no significant association between Fibroscan and HBV, HCV, NAFLD, or NASH. This can be explained by low number of F4 cases, this idea is supported by the results of a study, in which they mentioned an increase in the fibrosis stage improves the accuracy of TE (transient elastography). TE result in advanced fibrosis is more close to liver biopsy result [14].

It was concluded by Nudo et al [15]and Talwalkar et al(16), that detecting cirrhosis (stage IV fibrosis) by Fibroscan sensitivity and specificity were excellent. In the meantime, estimates of sensitivity and specificity in patients with moderate to severe (stages II-IV) fibrosis, were stated as good.

In our study, there is a significant relationship between Fibroscan results with the serum biomarker (fibrosis panel) including FIB-4 (p-value=0.001), APRI (p-value=0.001), with sensitivity and specificity of Fibroscan to FIB-4 were 91.2% and 26.7%, to APRI were 82.4% and 20%, respectively.

There are plenty of studies in which they support the use of a serum biomarker panel for the evaluation of fibrosis. Mallet et al [17] and Li et al [18] stated that the FIB-4 index has moderate accuracy in the evaluation of nil-to-moderate fibrosis, an excellent utility for detecting cirrhosis in patients with chronic hepatitis B infection. While it has suboptimal results in the exclusion of significant and severe fibrosis, and cirrhosis.

The FIB-4 successfully identified CHC patients who were at high risk of developing liver cirrhosis and HCC. [19]. In a study by Dyson et al [20], concluded that the FIB-4 score is a useful noninvasive method for diagnosing advanced fibrosis and slightly superior to other noninvasive tests in NAFLD.

Another noninvasive test for evaluating of fibrosis in chronic liver disease is APRI. Many studies have been shown that the APRI score is useful in the diagnosis of advanced fibrosis and cirrhosis especially chronic hepatitis B, chronic hepatitis C, and NAFLD. Although in a study they stated that the APRI score in autoimmune hepatitis does not seem to have diagnostic value [21-23].

According to the present study, significant associations were observed between steatosis grades and each of the patients' age, NAFLD, NASH, alcoholic hepatitis, BMI, and ultrasonography results. Our study is similar to others in terms of accuracy in detecting steatosis, as stated by Jun et al [24] and Lee et al [25] the capacity of CAP in diagnosing steatosis was an effective method.

This study showed a significant association between steatosis grade and HBV and hepatitis C virus (HCV) infection. This result in terms of HBV infection is similar to Petta et al [26] in which CHB patients (those nondrinkers) had a high prevalence of steatosis. Our study is similar to Seidel et al [27] study, as they mentioned the common feature in CHC infection is hepatic steatosis, also they found a correlation between

increased steatosis and increased liver injury and fibrotic progression in CHC infection.

Chronic hepatitis B steatosis not related to viral effect but it was seeming to be a result of metabolic causes attributable to the host rather than the effect of the viruses. Data from some studies suggest that hepatic steatosis in CHB is related to host factors such as metabolic syndrome or higher body mass index and waist circumference. Meanwhile, they found that the course of CHB infection in terms of fibrosis progression does not affect by hepatitis steatosis [28, 29].

We found a significant association between NAFLD and steatosis grade. This is in concordance with findings in other studies like Hossain et al [30] and Paul et al [31] as they concluded that a large proportion of NAFLD patients has components of metabolic syndrome which will increase the risk for steatosis and advanced fibrosis. In another study by Chalasani et al, patients with severe steatosis are more likely to have steatohepatitis [32].

In conclusin, there was a significant correlation between Fibroscan and other non-invasive methods like FIB-4 and APRI. Fibroscan has significant correlation with platelet count, level of ALP and serum albumin. There was a significant association between steatosis grades and incidence of HBV, HCV, NAFLD, NASH, alcoholic hepatitis.

Limitations in the study

We didn't perform a liver biopsy for the patients as a standard test to compare Fibroscan results and serum biomarker panel to it, because the patient didn't give consent to perform a liver biopsy. Our sample size was relatively small because we couldn't perform biopsy for every case of CLD as it is relatively costly and not available in general hospital.

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