

Acoustic Radiation Force Impulse in Alcoholic Liver Disease

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Abstract: Alcoholic liver disease (ALD) is the most common liver disease. It is underestimated and under diagnosed. An early diagnosis is absolutely essential since it [1] helps to identify patients at genetic risk for ALD; [2] can trigger efficient abstinence namely in non-addicted patients; and [3] initiate screening programs to prevent life-threatening complications. Acoustic radiation force impulse (ARFI) elastography has great utility in the measurement of liver fibrosis in alcoholic liver disease. Liver fibrosis is a common pathway for several liver injuries. Our study was done on 50 patient suspected to have alcoholic liver disease for ultrasound scan of abdomen. The mean liver stiffness in normal patients was found to be 1.087 m/s. Mean ARFI velocity in ALD in our study was 1.83 m/s compared with biopsy. ARFI imaging is a promising imaging modality for assessing the presence or absence of advanced fibrosis in patients with liver disease

Keywords: ARFI, ALD, Elastography, Fibrosis.

INTRODUCTION

Alcoholic liver disease (ALD) is one of the most common complications and a leading cause of alcohol-related death, due to liver cirrhosis and its complications. In 2004, 3.8% of all global deaths and 4.6% of global disability-adjusted life-years were attributable to alcohol consumption [4]. Liver fibrosis is a common pathway for several liver injuries. Accurate assessment of the degree of liver fibrosis is important for estimating prognosis and deciding on an appropriate course of treatment for cases of chronic liver disease (CLD) with various etiologies.

Because of the inherent limitations of liver biopsy, there is a great need for non-invasive and reliable tests that accurately estimate the degree of liver fibrosis. Ultrasound (US) elastography is considered a non-invasive, convenient, and precise technique to grade the degree of liver fibrosis by measuring liver stiffness.

A new ultrasound technique has recently emerged: acoustic radiation force impulse (ARFI) elastography. The device generates a short-duration (262 ms) acoustic pulse by ultrasound. This pulse creates mechanical excitation and displacement of tissue. The deformation induced by the acoustic pulse is followed by a relaxation process after which the tissue returns to its original configuration, generating a shear wave. The speed of this wave is calculated, providing a quantitative measurement. The present study aim is to assess the liver stiffness in various forms of ALD and FLD/NAFLD as assessed by conventional ultrasound and thus evaluating the role of ARFI elastography.

STUDY

Our study aims to assess the role of ultrasound based elastography method of liver called ARFI elastography in present day radiology practice and how it can aid in early diagnosis of fibrosis along with the conventional ultrasound of liver. The study was done on 50 patient suspected to have alcoholic liver disease and fatty liver disease for ultrasound scan of abdomen to the Department of Radiodiagnosis at Sree Balaji Medical College and Hospital, Chennai by purposive sampling technique.

Inclusion criteria

All patients clinically suspected to have ALD and FLD referred for ultrasound abdomen and Daily alcohol consumption of > 20g/dl

Exclusion criteria

History of drug intake that cause fatty liver, Other liver diseases other than ALD and Clinical history suggestive of viral hepatitis in the past

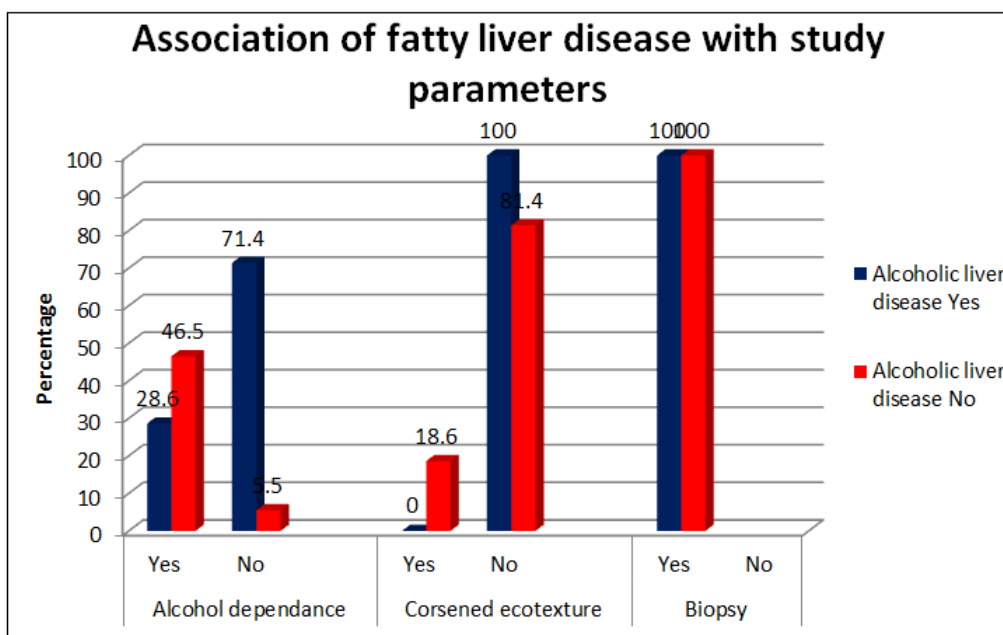
US of abdomen were performed using 4C-1 probe on SIEMENS S-2000 machine.

All patients were also subjected to ARFI elastography using intercostal approach from right lobe of liver (segment VI). Patients were positioned in supine position with arm abducted. Region of interest is selected free of vessels and ducts within 8cm from capsule of liver preferably about 2cms from liver capsule. Patients were then instructed to stop breathing for a moment and push pulse is sent and shear wave velocity is obtained. Ten valid measurements are taken. Using image-based localization and a proprietary implementation of ARFI technology, shear wave speed may be quantified, in a precise anatomical region, focused on a region of interest, with a predefined size,

provided by the system. Measurement value and depth are also reported, and the results of the elasticity are expressed in m/s [5, 6]. ARFI imaging offers the possibility of performing a quantitative measurement of the elasticity of the hepatic parenchyma during conventional US evaluations, without requiring additional transducers or other equipment [7].

Piscaglia *et al.*, [8] show that Virtual Touch Tissue Quantification is able to identify the presence of cirrhosis with good accuracy and produces results correlated with those obtained by transient elastography with Fibroscan

RESULTS



Association of fatty liver disease with study parameters

Association of Fatty Liver Disease with Study Parameters

		Fatty liver		P Value
		Yes	No	
Alcohol dependence	Yes	4	18	<0.001
		15.4%	75.0%	
	No	22	6	0.37
		84.6%	25.0%	
Coarsened texture	Yes	3	5	0.37
		11.5%	20.8%	
	No	23	19	
		88.5%	79.2%	
Biopsy	Yes	5	2	
		100.0%	100.0%	
	No	0	0	

sensitivity = 71.4%; specificity = 61%

Only 4(15%) of the fatty liver patients were alcohol dependent out of total 26 patients. This difference was found to be statistically significant.

Only 3 (11.5%) of the fatty liver patients had coarsened ecotexture out of total 26 patients. But, this difference was not found to be statistically significant.

Association of Fatty Liver Disease with Alcohol Dependence Study Parameters

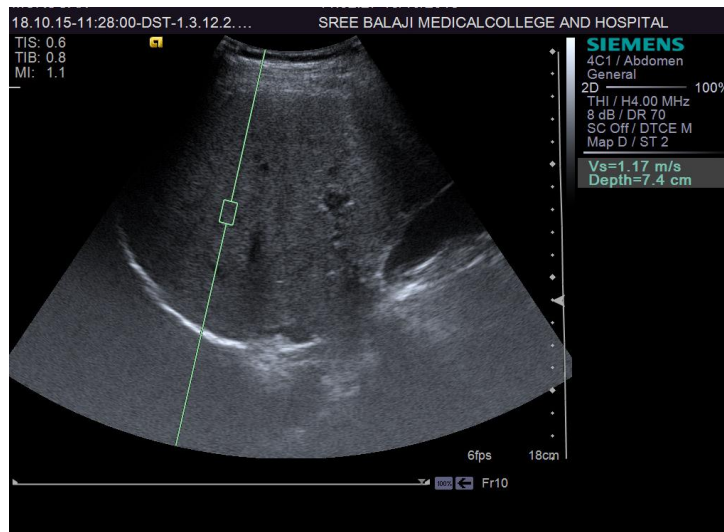
		Alcoholic liver disease		P Value
		Yes	No	
Alcohol dependence	Yes	2	20	0.37
		28.6%	46.5%	
	No	5	23	
		71.4%	53.5%	
Coarsened texture	Yes	0	8	0.21
		.0%	18.6%	
	No	7	35	
		100.0%	81.4%	
Biopsy	Yes	1	6	
		100.0%	100.0%	
	No			

sensitivity = 74.2%; specificity = 59%

Only 2(28.6%) of the alcoholic liver disease patients were alcohol dependent out of total 7 patients. But, this difference was not found to be statistically

significant. None of the fatty liver patients had coarsened ecotexture out of total 7 patients & this difference was not found to be statistically significant.

ARFI velocity	1.8324	.60079
	5.6418	1.25239



Liver elastography of right lobe region of interest is selected free of vessels and ducts

DISCUSSION

Alcoholic liver disease is defined by three stages of liver damage following chronic heavy alcohol consumption: fatty liver, alcoholic hepatitis, and fibrosis/cirrhosis

In our study fatty liver is classified into three grades using conventional US. Also patient with coarse liver echo texture are identified. Liver stiffness now is categorized into different stages of fibrosis using the predictive values given by Fierbinteanu Braticевич *et al.*, [9].

In our study commonest age group in patients with ALD was found to be between 51 to 60 years with 38.0% of patients falling in this group. This is followed by 61years and above group with 26.0% of patients In our study 64% were male and 36% were female with a ratio of almost 2:1.

In our study 28.5% of the alcoholics had changes consistent with alcoholic liver disease which is in concordance with study by McCullough *et al.*, [10].

Mean value of liver stiffness by ARFI elastography was in the range of FOF1 stage of fibrosis.

Eiler *et al.*, [11] concluded that the mean stiffness of liver in normal patient as 1.16 m/s. Mean liver stiffness by Sporea *et al.*, [12] was 1.19 m/s. Similarly, Yoon *et al.*, [13], Horster *et al.*, [14], Goerts *et al.*, [15], FierbinteanuBraticevici *et al.*, [9], Friedrich Rust *et al.*, [18], Pisgaclia *et al.*, [8] and D Onofrio *et al.*, [16] showed the mean liver stiffness in normal patients as 1.06, 1.19, 1.09, 1.18, 1.13, 1.13 and 1.56 m/s respectively.

Association of alcohol dependence with our study parameters showed sensitivity = 71.4% and specificity = 61%, Only 4(15%) of the fatty liver patients were alcohol dependent out of total 26 patients. This difference was found to be statistically significant.

However liver biopsy was done only for 7 patients in the present study which proved 100% of ARFI values positive to confirm the presence of fibrosis. Limitation of this study is liver biopsy. This is due to various drawbacks of liver biopsy most important being its invasiveness and lack of consent by patient for benign condition like ALD. None the less liver biopsy is the gold standard

SUMMARY

ALD and FLD/NAFLD is a disease of higher age group with male preponderance. Most of the participants in the age group of 51-60 (38%), while 88% had age more than 40 years. 64% were males & ~3% were females. Data regarding alcohol dependency shows that almost half of them were alcohol dependent. Only 16 % participants had coarsened ecotexture. 52% had fatty changes in liver & ~86% had alcoholic liver disease.

Mean ARFI velocity in ALD and fatty liver in our study was 1.83 & ARFI depth was 5.64, which denoted F3-F4 fibrosis stage. In comparison to the cut off given by Toshima *et al.*, [17] 1.88 m/s and Fierbinteanu Braticevici *et al.*, [9].

The mean liver stiffness in normal patients was found to be 1.087 + 0.087 m/s which is in agreement with most of the studies. This also proves high specificity of ultrasound in detecting normal liver without fatty infiltration.

CONCLUSION

Alcoholic liver disease (ALD) and fatty liver is, either alone or in association with other comorbidities such as obesity or viral hepatitis, the leading cause of liver disease. It is a disease of higher age group with male preponderance. Most are milder forms of fatty liver with benign outcome. The mean liver stiffness in normal patients was found to be 1.087 + 0.087 m/s. Mean ARFI velocity in ALD and fatty liver in our study was 1.83 + 0.074 m/s which is in agreement with most of the studies. The limitation of this study was that liver biopsy was not used on all

patients to confirm the histology and therefore there is a need for future study with liver biopsy. ARFI imaging is a promising imaging modality for assessing the presence or absence of advanced fibrosis in patients with liver disease. ARFI is a new non-invasive imaging based technique able to estimate liver stiffness diagnosing cirrhosis with good accuracy. The first assessment of patients with a suspicion of liver disease can be therefore, easily performed with both, conventional ultrasonography and ARFI for liver stiffness assessment in a single step.

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