The Professional Medical Journal
www.theprofesional.com

DOI: 10.17957/TPMJ/16.3163

ORIGINAL PROF-3163

SHEAR WAVE ELASTOGRAPHY;

ASSESSMENT OF LIVER FIBROSIS IN A PATIENT OF CHRONIC LIVER DISEASE ASSOCIATED INFECTED BY HEPATITIS B AND C

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Article received on:
13/11/2015
Accepted for publication:
28/11/2015
Received after proof reading:
13/01/2016

ABSTRACT… Objectives: Assessment of liver fibrosis by shear wave elastography in a patient of chronic liver disease associated infected by hepatitis B and C. **Study Design:** Observational Study. **Place and Duration of Study:** This study was conducted in the Department of Radiology JPMC Karachi from January to September 2015. **Methodology:** All the diagnosed cases of Chronic liver disease aged between 30 to 60 years and both gender associated with hepatitis B and C were selected. Patients using lipid-lowering drugs were excluded from this study. Assessment of liver fibrosis dividing into two groups, 1st group patients suffering liver disease since 2 years and 2nd group more than 2 years on SWE Qualitative and Quantitative analysis was done and staging of fibrosis according to METAVIR SCORE was done. Shear wave elastography and scoring are F0-F1 (5.3-7.1), F>2 (7.5-8.5) Grade 1-Mild, F>3 (9.5-13) Grade 2- Moderate and F>4 (13.1-18.8) Grade 3-Severe. **Results:** Out of the 80 patients, the majority was found to be male. 44(55%) males and 36(45%) females. Ratio between the male and female is 1.2:1. Mean age was found to be 44.57+7.54 years. Mostly Grade 2- Moderate changes observed in liver were 15(18.75%) of Hepatitis B Surface Antigen positive patients while 14(17.5%) Hepatitis C Virus Antibodies positive patients. Followed by Grade 1-Mild changes were 12(15%) of Hepatitis B+ve patients and 7(8.75%) Hepatitis C+ve positive patients. Grade 3-Severe were 9(11.25%) of Hepatitis B+ve patients and 4(5%) Hepatitis C+ve positive (Table No 2). 4(5%) cases observed mild changes in both positive. **Conclusion:** Elastography techniques is noninvasive method can provide clinicians with innovative options as potential alternatives to liver biopsy for improving the quality of care for those patients with liver diseases.

Key words: Shear Wave Elastography, Metavir score, Hepatitis, Fibrosis,

Article Citation: Saldera K, Naqvi NF, Mahmood T, Shaikh SS. Shear wave elastography; assessment of liver fibrosis in a patient of chronic liver disease associated infected by hepatitis B and C. Professional Med J 2016;23(1):099-103. **DOI:** 10.17957/TPMJ/16.3163

INTRODUCTION

Chronic liver diseases are most important public health issues as they account for considerable morbidity and mortality worldwide.[1] Early findings and staging of liver fibrosis is essential in order to make sure best possible treatment planning for patients with chronic liver diseases, which can ultimately direct to, decompensated liver disease, cirrhosis and hepatocellular carcinoma (HCC).[2-4] Hepatic fibrosis is the final result of a wide variety of liver injuries. Fibrosis is a wound healing response, which is similar histologically observed in essentially all organs.[9, 10]

Many previous studies have established that the degree of fibrosis also has predictive significance in patients with chronic hepatitis.[5,6] Up till now liver biopsy has been extensively acknowledged as the most specific test for the assessment of Grading of liver fibrosis. The frequency of cirrhosis is rising due to the development of chronic hepatitis, non-alcoholic fatty liver disease (NAFLD) and more particularly non-alcoholic steato-hepatitis (NASH). Liver fibrosis is therefore a vital public health issue.[3]

To assess liver fibrosis, two types of non-invasive methods exist.[3] First non-invasive technique is the assessment of blood serum markers including hyaluronic acid and combination of various blood markers.[8] Other technique is based on a physical parameter that measures the tissue elasticity and is called elastography. Conventional ultrasound cannot distinguish specifically the different liver

fibrosis stages.[8] It has confines in the evaluation of diffuse liver diseases. Due to its subjective nature and inconsistency in assessing alterations of the hepatic parenchyma echotexture and liver dysmorphia, conventional US imaging is not able to distinguish hepatic fibrosis stages accurately.

Recently, on ultrasound imaging, Shear wave elastography (SWE) has an incorrigible role in the assessment of suggestive liver diseases and staging of liver fibrosis.[8] Shear wave elastography (SWE) was introduced in 2005 on the diagnostic imaging device, called Aixplorer TM (Super Sonic Imagine, Aix-en-Provence, France). It relies on the measurement of the shear wave propagation speed in soft tissue.[13] The benefits of SWE in the management of patients with chronic liver disease due to Hepatitis infection have already been demonstrated.[3-5] The reliability and applicability of the technique have been evaluated as well and were reported to be similar to already existing non-invasive techniques.[15-16]

Elastography techniques include transient elastography (FibroScan, ARFI, Real Time Elastography, Shear Wave mode elastography and elasto-MR. Elastography can replace subjective palpation and is anticipated to image the mechanical properties of tissues and specifically their stiffness.[8]

Different levels of fibrosis exist which in practice are assessed using a histological score. Now a days, On Shear wave Elastography the most extensively used is the METAVIR score, which incorporate five stages of fibrosis: F0 (no fibrosis), F1 (mild fibrosis), F2 (moderate fibrosis or clinically significant fibrosis), F3 (no cirrhosis: but severe fibrosis) and F4 (cirrhosis).

Staging liver fibrosis in patients with chronic liver disease is necessary for patient management as it allows to identify the severity of liver damage, assess the progression and for the monitoring and screening of liver fibrosis.[3]

MATERIAL AND METHODS

This study was conducted in the Department of Radiology JPMC Karachi from January to September 2015. All the diagnosed cases of Chronic liver disease aged between 30 to 60 years and both gender associated with hepatitis B and C were included in this study. Patients with liver cirrhosis due to other aetiology like alcoholic, nonalcoholic fatty liver disease, autoimmune, or cryptogenic cirrhosis. Patients having associated diseases which affecting blood lipid such as diabetes mellitus, cancer, chronic renal failure, acute pancreatitis, recent parenteral nutrition, cardiovascular and cerebrovascular disease, and hypothyroidism. Patients using lipid-lowering drugs were excluded from this study. Assessment of liver fibrosis dividing into two groups, 1st group patients suffering liver disease since 2 years and 2nd group more than 2 years on SWE Qualitative and Quantitative analysis was done and staging of fibrosis according to METAVIR SCORE was done. Shear wave elastography and scoring are F0-F1 (5.3-7.1), F>2 (7.5-8.5) Grade 1-Mild, F>3 (9.5-13) Grade 2- Moderate and F>4 (13.1-18.8) Grade 3-Severe.

RESULTS

Out of the 80 patients, the majority was found to be male. 44(55%) males and 36(45%) females. Ratio between the male and female is 1.2:1. Mean age was found to be 44.57+7.54 years (30 to 60 years). Most of the patients were Hepatitis B Surface Antigen positive in 17(21.25%) patients followed by Hepatitis C Virus Antibodies positive in 32(40%) patients and both positive 9(11.25%) patients (Table-I).

Mostly Grade 2- Moderate changes observed in liver were 15(18.75%) of Hepatitis B Surface Antigen positive patients while 14(17.5%) Hepatitis C Virus Antibodies positive patients. Followed by Grade 1-Mild changes were 12(15%) of Hepatitis B+ve patients and 7(8.75%) Hepatitis C+ve positive patients. Grade 3-Severe were 9(11.25%) of Hepatitis B+ve patients and 4(5%) Hepatitis C+ve positive (Table-II). 4(5%) cases observed mild changes in both positive (Table-II).

Liver Elastrography (KPa)	Hepatitis B Surface Antigen		Hepatitis C Virus Antibodies		Hepatitis B Surface Antigen + Hepatitis C Virus Antibodies		Means KPa (n=80)
	No: of Patients	% Age	No: of Patients	% Age	No: of Patients	% Age	
Normal F0-F1 (5.3-7.1)	6	7.5%	4	5%	0	0%	3.1+ 2.8
Grade 1-Mild F>2 (7.5-8.5)	12	15%	7	8.75%	4	5%	8+ 1.1
Grade 2- Moderate F>3 (9.5-13)	15	18.75%	14	17.5%	2	2.5%	11.8+ 1.2
Grade 3-Severe F>4 (13.1-18.8)	9	11.25%	4	5%	3	3.75%	14.6+ 2.8

Table-II. Liver elastrography (KPA)

Variable	No. Patients	Percentage
Gender		
• Male	44	55%
• Female	36	45%
Age		
• 30-40 years	17	21.25%
• 41-50 years	41	51.25%
• 51-60 years	22	27.50%
Hepatitis B Surface Antigen		
• Positive	42	52.5%
Hepatitis C Virus Antibodies		
• Positive	29	36.25%
Hepatitis B Surface Antigen + Hepatitis C Virus Antibodies		
• Both Positive	9	11.25%

Table-I. Demographic Variable

DISCUSSION

Asessment of the degree of fibrosis is an essential component in medically managing patients with chronic liver disease (CLD), especially related to Hepatitis B or C.[17] This study was conducted to determine the effectiveness of non-invasive techniques, such as Elastrography, as an appropriate and clinically relevant tool in differentiating fibrosis and cirrhosis, as when compared to invasive methods, such as liver biospy. The liver biospy procedure is reputed by healthcare professionals as being the gold standard in evaluating CLD patients, despite numerous limitations and drawbacks with the procedure.[18] From a patient standpoint, the procedure is costly, poses potential risks and complications, along with creating variability in sample gathering[18]. Complications related to biospy include excessive bleeding, puncture of adjacent viscera, and pneumothorax.[19] Discrepanies of approximately 10-20% exist with the performance of a liver biopsywithvariability in accuracy due to a small specimen sample,as well as the level of operator expertise in acquiring the sample.[19,20] Whereas non-invasive procedures such as serum biomarkers and elastography provide numerous benefits to the patient such as minimal discomfort, convienent repeated evaluationfor progression of fibrosis without additional discomfort, along with a standard and objective interpretation.[18]

This study was conducted on a total of 80 patients of both genders with the medical diagnosis of chronic liver disease. The majority of patients analyzed in the study were male, comprising of over 55% of the patient population, while only 45% or 36 patients were females. The patient ages ranged between 30 years to a maximum of 60 years, with over 50% in the 41 to 50 years range, followed secondly by 51 to 60 years age in over 27% of the sample patient population. The under 40 years age range comprised of a small precentage of only 21% of the pateints in this study. The data regarding viral markers was also collected from the patients in this study. The viral markers noted in this study were Hepatitis B surface antigen as well as Hepatitis C virus antibodies. A small 11% percent of patients tested positive for both viral markers, meaning a mere 9 patients had both the antigen and antibodies out

of the total 80 sample size.

Transient elastography (TE) is a tool used to determinethe degree of stiffness present in the liver.[17] This non-invasive technique uses elastic waves and low frequency ultrasounds of about 50 Hertz. The equipment consists of a probe, an ultrasound system and an electronic unit for data processing.[17] A probe generates low amplitude pulsations which are then conducted by a transductor and transferred to liver tissue. Concurrently, the ultrasound system creates pulses that monitor and regulatethe speed of transmission of the elastic waves within the liver tissue or parenchyma.[17] The speed of propagation is directly proportional elasticity, meaning the greater stiffness of the tissue, the quicker the propagation of elastic waves.[17] Thus, readings with high results usually signify the existence of fibrosis in liver tissue.[17] The final result is the median of all accurate readings, which is considered to be representative of the hepatic elasticity, expressed in kilopascals (kPa), within a range of 5.3-18.8 kPa. The liver elastography staging of fibrosis is categorized from F0 through F4, differentiating the progression of fibrosis as well as identifying cirrhosis.

The liver elastography data was analyzed with relation to the sample patient population of 80 patients. Of the 42 patients that solely tested positive for the viral marker Hepatitis B surface antigen, 19% were determined to have Grade 2-Moderate fibrosis, followed closely by 15% having Grade 1- Mild fibrosis with relation to their chronic liver disease. 11.5% of patients with positive Hepatitis B surface antigen were categorized to have Grade 3-Severe fibrosis or cirrhosis. From the 80 patients in the sample size, 29 patients were tested to be positive solely for the Hepatitis C virus antibodies, 17.5% of these patient were evaluated to have Grade 2- Moderate fibrosis, over 9% having Grade 1- Mild fibrosis in the liver parenchyma. 5% equally were determined to have Grade 3-Severe fibrosis, while 5% were also evaluated to have no fibrosis or normal liver tissue. Of the 9 patients that tested positive for both viral markers, only 5% of those patients were evaluated to have Grade 1-Mild fibrosis of the liver tissue. While less than 3% were determined to have Grade 2-Moderate fibrosis and an even smaller percentage were determined to have Grade 3-Severe fibrosis. A mean KPa of 14.6+ 2.8 were determined to have Grade 3-Severe fibrosis. While a KPa mean of 11.8+1.2 have moderate fibrosis or Grade 2.

V. Papastergiou et al concluded that there is no single noninvasive method or one serum biomarker to replace the benchmark of the liver biospy, therefore both modalities should be used collaboratively in the monitoring of the CLD patient with liver fibrosis.[18] This study determined that shear-wave elastrography aids in differentiating the severity of fibrosis present in liver parenchyma, but it is still considered an inferior assessment tool compared to the gold standard of the liver biospy. However, when elastography and serum biomarkers are used in combination, decision-making is made with greater accuracy in the medical management of the CLD patient with liver fibrosis.

CONCLUSION

Elastography techniques is noninvasive method can provide clinicians with innovative options as potential alternatives to liver biopsy for improving the quality of care for those patients with liver diseases, in terms of the diagnosis, prognosis, and follow up of fibrosis progression and evaluation of treatment efficacy.

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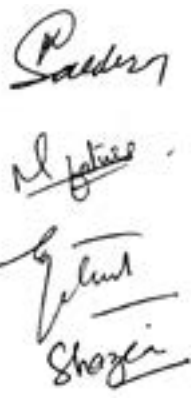
1	Dr. Kausar Saldera	Conception and design, Statistical expertise, Critical revision of the article for important intellectual content	
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