ROLE OF ELASTOGRAPHY AS A SCREENING TEST IN DETECTING EARLY LIVER FIBROSIS IN PATIENTS WITH NORMAL LIVER ARCHITECTURE ON CONVENTIONAL ULTRASOUND

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ABSTRACT

Cirrhosis of liver is characterized by replacement of normal liver tissue by fibrosis, scar tissue and regenerative nodules. Clinical manifestations like ascites or splenomegaly help point to the diagnosis of cirrhosis but the early detection of fibrosis is not possible by simple grey scale ultrasound as these features generally emerge late.

Objective: The objective of the study was to check the sensitivity of detecting early liver fibrosis by ultrasound elastography in patients who have normal liver architecture on conventional ultrasound but persistent deranged liver function tests.

Study Design: It was a cross sectional study.

Place and Duration of Study: This study was conducted in the Department of Radiology, Combined Military Hospital Lahore. Six months from 30th April to November 2013.

Material and Methods: Three hundred (300) patients fulfilling the inclusion criteria were selected for this study. Combined Autocorrelation Method is the basis of the technique that calculated relative hardness of tissue from the degree of tissue distortion and this information is displayed as a color image. Color coding and amount of displacement of tissue enabled us to detect early fibrotic changes. Young's modulus elasticity formula that quantifies the tissue stiffness was applied. Hard tissue has higher strain ratio so higher Young's modulus than soft tissue.

Results: The mean age of the patients was 53.9 ± 7.1 years. In the distribution of patients by sex, there were 186 (62.0%) male and 114 (38.0%) female patients. In the distribution of patients by frequency of liver fibrosis, there were 220 (73.3%) patients having liver fibrosis and 80 (26.7%) patients had no liver fibrosis.

Conclusion: It is concluded that real time ultrasound elastography is a clinically useful test for detecting early liver fibrosis and was detected in 73.3% patients in our study.

Keywords: Early liver fibrosis, ultrasound elastography, conventional ultrasound.

INTRODUCTION

Cirrhosis is characterized by replacement of liver tissue by fibrosis, scar tissue and regenerative nodules. Cirrhosis is also a leading cause of morbidity and mortality[1]. The study was designed to determine the sensitivity of ultrasound elastography in detecting early liver fibrosis in patients who had normal liver texture on conventional ultrasound but persistent deranged liver function tests. Till now no study has been conducted in Pakistan for evaluating its role in cirrhosis.

Early liver fibrosis on elastography is characterized by formation of fibrous tissue and nodules that showed scattered areas of blue or green on color map of ultrasound elastography that is considered hard and of intermediate elasticity respectively.

MATERIAL AND METHODS

This prospective cross sectional study was conducted in the Department of Radiology, Combined Military Hospital Lahore. The sample size calculated by non probability purposive sampling estimated using 95% confidence level, 5% margin of error with an expected frequency of liver fibrosis 76% is 300 patients. Study duration was six months from 30th Apr to 8th Nov 2013.

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Inclusion Criteria
- Patients diagnosed with early chronic liver disease on the basis of persistent elevated bilirubin (>1.2mg/dl)
- Patients with persistently deranged ALT (alanine transaminase) for more than 6 months i.e above 56 IU/L

Exclusion Criteria
- Obese patient with BMI greater than 30
- Patient with abnormal liver texture on ultrasound

Three hundred (300) patients fulfilling the inclusion criteria were selected from outpatient medical department of Combined Military

liver elasticity for quantitative assessment of liver fibrosis[6,7]. Tissue strain before and under mild compression is represented as echo signals which are compared and analyzed. The information is displayed as a color coded image. The red color usually corresponds to soft tissue, blue to hard tissue and green corresponds to intermediate tissue stiffness[8]. The elastography image is constructed by the amount of displacement of the reflected ultrasound echoes under compression. In soft tissue, the amount of displacement of the reflected ultrasound echoes is high, whereas, in hard tissue, amount of displacement is low because soft tissue can be

Table-I: Distribution of patients by age (n=300).

Age (Years)	No. of patients	Percentage
40-45	70	23.3
46-50	23	7.7
51-55	70	23.3
56-60	92	30.7
61-65	45	15.0
Mean ± SD	53.9 ± 7.1	

N: Number of patients
SD: Standard deviation

Table-II: Distribution of patients by sex (n=300).

Sex	No. of patients	Percentage
Male	186	62.0
Female	114	38.0
Total	300	100.0

n: Number of patient

Table-III: Distribution of patients by early liver fibrosis (n=300).

Liver fibrosis	No. of patients	Percentage
Yes	220	73.3
No	80	26.7
Total	300	100.0

n: Number of patients

Hospital Lahore. Permission was sought from hospital ethical committee. Written informed consent was taken from every patient. Elastography of the liver was performed with elastoscan mode of ultrasound machine SONIX TOUCH using curved and linear array on patients in supine position. Real-time tissue elastography (RTE), a newly developed non-invasive ultrasound modality which measures

compressed more than hard tissue. Tissue hardness reflects the degree of fibrosis in liver. Elastography probe was placed over right intercostal space. Echo signals representing tissue strain before and under mild compression was compared and analyzed. Combined Autocorrelation Method is used in this scan that calculated relative hardness of tissue from the degree of tissue distortion and this information is

displayed as a color image. Early fibrotic changes were detected by using color coding and amount of displacement of tissue. In soft tissue, the amount of displacement of the reflected ultrasound echoes was high, whereas, in hard tissue, amount of displacement was low. Young's modulus elasticity formula that quantifies the tissue stiffness was applied. Hard tissue has higher strain ratio so higher Young's modulus than soft tissue. So this study determined the frequency of detection of early liver fibrosis by real time tissue elastography in patients with deranged liver function tests. All this information was collected on a prescribed proforma (attached).

Statistical Analysis

All the collected information was transferred to SPSS version 12 and analyzed. The study variables were age, gender and early liver fibrosis. The quantitative variables like age were presented as mean and standard deviation. Qualitative variables like gender and early liver fibrosis on ultrasound elastography were presented as frequency and percentages.

RESULT

The mean age of the patients was 53.9 ± 7.1 years. There were 70 (23.3%) patients in the age range of 40-45 years, 23 (7.7%) patients in the age range of 46-50 years, 70 (23.3%) patients in the age range of 51-55 years, 92 (30.7%) patients in the age range of 56-60 years and 45 (15.0%) patients in the age range of 61-65 years (table-I).

In the distribution of patients by sex, there were 186 (62.0%) male and 114 (38.0%) female patients (table-II).

In the distribution of patients by frequency of liver fibrosis, there were 220 (73.3%) patients having liver fibrosis and 80 (26.7%) patients had no liver fibrosis (table-III).

DISCUSSION

Early cirrhosis patients should be treated as soon as possible, because it is the best treatment period. If timely correct treatment is given the condition may be reversed. The patients are asymptomatic in early stages of liver disease and laboratory tests and conventional ultrasound has poor predictive value in assessing fibrosis. This has resulted in development of non-invasive methods of diagnosis and ultrasound elastography is one of them[3,4].

In our study 73.3% patients had early liver fibrosis on ultrasound elastography. As compared with the study of Talwalkar et al[5] showed that ultrasound elastography has detected 76% patients with the diagnosis of early liver fibrosis, which is comparable with our study.

The limitations of liver biopsy has led to development of non-invasive techniques for the early detection of liver fibrosis[9,10]. In the post-Liver Transplant patients studies have shown that tissue elastography (TE) can accurately predict the severity of allograft fibrosis in the HCV-infected patient[11].

The heterogeneity in meta-analyses of diagnostic tests can likely be due to differences in study design methodology in addition to the technical performances of RTE and liver biopsy[5]. The liver fibrosis staging accuracy is also influenced by core size of liver biopsy tissue[12,13]. Criteria for liver biopsy specimens (i.e ≥20 mm in length and/or ≥11 complete portal tracts) have been described[13,14]. In practice, however, samples meeting these criteria are rarely achieved[13-15]. Hence, intrinsic errors of liver biopsy measurements may limit the diagnostic accuracy of noninvasive evaluations[15].

Rigamonti et al[12] used the Ishak score, which has 0 to 6 stages to describe hepatic fibrosis. The assessment, definition and follow-up of the rate of fibrosis progression is dependent upon complexity of histological staging[16]. However the categorical nature of these scores renders them suboptimal for assessing efficacy, and this may be a source of heterogeneity[17].

CONCLUSION

It is concluded from this study that real time ultrasound elastography appears to be clinically useful test for detecting early liver fibrosis as in our study early liver fibrosis was detected in 73.3% patients by ultrasound elastography.

CONFLICT OF INTEREST

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