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Original Research Article

COMPARISON OF DIAGNOSTIC VALUE OF SHEAR WAVE ELASTOGRAPHY AND LIVER BIOPSY IN ASSESSING LIVER FIBROSIS

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Abstract: *This prospective study was designed to compare the specificity and sensitivity of shear wave elastography (SWE) and liver biopsy in liver fibrosis staging. The study was conducted at Bakhtawar Amin Trust Hospital Multan from July 2021 to July 2022. The study was conducted on 90 patients who underwent liver biopsy due to pathologies, including congenital liver diseases or as possible liver donors. An experienced radiologist performs shear wave elastography. An experienced histopathologist assessed biopsy specimens. The mean age of the patients was 30 years. Out of 90 patients, 16 (17.7%) had Hep B or C, 20 (22.2%) were liver donors, and 54 (60%) had other liver diseases. Elastography results showed mean liver stiffness in F0–F1, F2, F3, and F4 stage fibrosis to 5.48 ± .52 kPa, 8.22 ± .42 kPa, 9.56 ± .32 kPa, and 12.41 ± 2.9kPa, respectively. Results of liver biopsy and SWE were significantly correlated (p=.0001).Shear wave elastography is an effective tool for the assessment of liver fibrosis*.

Keywords: Shear wave elastography, liver biopsy, liver fibrosis

Introduction

Chronic liver disease (CLD) occurs due to various factors which cause increased fibrous tissue deposition in liver parenchyma leading to cirrhosis. As the fibrosis progresses, there is an increased risk of complications such as hepatocellular carcinoma (HCC), hepatic insufficiency and portal hypertension. Liver cirrhosis or severe fibrosis, which remains asymptomatic, is termed "compensated advanced chronic liver disease" (CACLD) (Abraldes et al., 2016; Augustin et al., 2017; Barr et al., 2020). It is the cause of hepatic morbidity and mortality; therefore, for proper management, it is essential to assess the stage of liver disease(Buchanan and Sinclair, 2021). An early intervention slows disease progression, for which non-invasive tools for excluding or diagnosing CACLD are essential. Liver biopsy has been the gold standard for diagnosing inflammation and fibrosis. Other non-invasive procedures have been recently used to confirm liver disease stages (Berzigotti et al., 2018; Dietrich et al., 2019). Liver fibrosis results in stiffening of the liver; quantitative elastography is a non-invasive tool for measuring liver stiffness. Quantitative elastography includes two-dimensional shear wave elastography (2-D SWE), acoustic radiation force impulse (ARFI) and transient elastography (TE) (Monti et al., 2020). 2-D SWE is a non-invasive tool for measuring liver stiffness. It uses mechanical waves which propagate through human tissue to measure stiffness level. Propagation of shear waves with higher speeds indicates stiffer tissues, while low speed indicates softer tissues. Using this mechanism, liver stiffness in fibrosis is measured by 2-D SWE. This study has been conducted to assess the specificity, sensitivity and accuracy of SWE compared to liver biopsy to diagnose liver fibrosis.

Methodology

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This prospective study was conducted at Bakhtawar Amin Trust Hospital Multan from July 2021 to July 2022. The study included patients referred for liver biopsy due to pathologies, including congenital liver diseases or as a possible liver donor. Those with any chronic illness were excluded. A total of 90 patients were included in the study. Informed consent of the participants was taken. The ethical board of the hospital approved the study. All participants underwent liver biopsy and SWE in the same setting. 2-D SWE was used for achieving liver stiffness measurement (LSM). During an ultrasound, the region of interest (ROI) was considered the safety of biliary structure or prominent vasculature. Patients were placed in the left decubitus or prone position. The right liver lobe was targeted using an intercostal imaging approach. At least 10 serial measurements were taken while the patient was asked to suspend respiration. Measurements and a statistical summary were recorded. An experienced radiologist evaluated the results. Immediately after 2-D SWE, the biopsy was performed under local anesthesia. An 18 G automated needle was used to obtain the sample from the right lobe. Biopsy results were assessed by an experienced pathologist, unaware of the results of SWE, using the METAVIR scoring system.

SPSS version 22.0 was used for statistical analysis. Continuous variables were represented as mean and standard deviation. Categorical variables were represented as frequency and percentage. Accuracy, specificity, sensitivity, positive predictive value (PPV) and negative predictive value (NPV) of SWE were calculated. The Association between stages of fibrosis was assessed through a chi-square test. Univariate analysis was done to compare mean liver stiffness at different stages. P values <0.05 were considered statistically significant.

Results

The mean age of the patients was 30 years. Out of 90 patients, 16 (17.7%) had Hep B or C, 20 (22.2%) were liver donors, and 54 (60%) had other liver diseases. Elastography results showed mean liver stiffness in F0–F1, F2, F3, and F4 stage to be 5.48 ± .52 kPa, 8.22 ± .42 kPa, 9.56 ± .32 kPa, and 12.41 ± 2.9kPa, respectively. The mean liver stiffness differs significantly in different fibrosis stages (p<.0001) (Table I). Results of liver biopsy and SWE were significantly correlated (p=.0001). According to SWE results, 51 (56.6%) subjects had stage F0-F1 fibrosis, 20 (22%) had stage F2, and 15 (16%) had stage F3. Sensitivity of F0–F1, F2, F3, and F4 was 88.6%, 31.3%, 20.1%, and 34.2% respectively. Specificity for F0–F1, F2, F3, and F4 was 61.6%, 83.6%, 91.5% and 97.0%, respectively (TABLE II and III).

In Hep B/C, mean liver stiffness in F0–F1, F2 and F3 was 5.34=3 ± 0.32 kPa, 7.29 ± 0.68 kPa and 8.47± 0.45 kPa respectively. Additionally, the accuracy of SWE in diagnosing stages of fibrosis in Hep B or C was assessed. It was 59% and 47.7% for F0–F1 and F2, respectively. The sensitivity for stages F0–F1 and F2 was 63.4% and 29.6%, respectively. F0–F1 and F2 specificity were 58.2% and 63.4%, respectively.

For other liver pathologies mean liver stiffness in F0–F1, F2, F3, and F4 was 6.49 ± 0.69 kPa, 7.28 ± 0.29 kPa, 8.33 ± 0.24 kPa, and 12.43 ± 2.9 kPa respectively. The accuracy of SWE for other liver pathologies was significantly correlated with the accuracy of liver biopsy (p = .0005).

In donors, the mean liver stiffness in F0–F1 was 5.07 ± 0.51 kPa. Diagnostic accuracy in different fibrosis stages was not assessed as all donors have stages F0-F1.

Table I Findings of SWE in different stages of fibrosis

Fibrosis stage	n	Mean liver stiffness	Standard deviation	Minimum	Maximum	Range
F0-F1	51	5.48	.52	3.38	6.25	3.02
F2	20	8.22	.42	6.77	7.89	1.23
F3	15	9.56	.32	8.15	9.18	1.02
F4	4	12.41	.41	9.53	15.56	7.4

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Table II Comparison of SWE and Liver biopsy scores

		SWE score				
		F1-F0	**F2**	**F3**	**F4**	**Total**
Biopsy score	**F1-F0**	32	1	4	0	37
	F2	16	15	4	0	35
	F3	3	0	3	4	10
	F4	0	4	4	0	8
	Total	51	20	15	4	90

Table III Diagnostic value of SWE

	F0-F1	**F2**	**F3**	**F4**
Sensitivity	88.6%	31.3%	20.1%	34.2%
Specificity	61.6%	83.6%	91.5%	97%
PPV	62.3%	45.5%	91.5%	51.2%
NPV	88.5%	64.6%	90.4%	92.3%
Accuracy	73.4%	62.2%	82.2%	91.5

Discussion

Imaging techniques are now used for assessing liver fibrosis. MR elastography and ultrasound elastography have shown good clinical results (Jang et al., 2021), though ultrasound has better availability and lower cost. 2-D SWE is a non-invasive tool for assessing liver fibrosis. Studies have shown its efficacy in giving a disease-specific measure of liver stiffness (Barr et al., 2020). SWE can predict advanced or significant fibrosis more accurately than serum fibrosis panels. It can also be an alternative to liver biopsy in some cases. Previously comparative studies have been done to assess the diagnostic value of SWE in staging liver fibrosis in chronic liver disease and Hepatitis B and C (Cassinotto et al., 2020; Mercedes et al., 2020; Miele et al., 2020). These studies have variable findings on the accuracy of SWE; however, its specificity and sensitivity are comparable to liver biopsy. Another study also found out that shear wave elastography is a reliable non-invasive modality for assessing liver elasticity (Popescu et al., 2019). In a study conducted on HBV patients for assessing the diagnostic value of SWE and liver biopsy, mean liver stiffness in F1, F2, F3, and F4 stage was 6.70 ± 2.65 kPa, 7.34 ± 3.84 kPa, 8.82 ± 3.24 kPa and 12.88 ± 5.25 kPa respectively(Kim and El-Serag, 2019), this was inline with the results of our study. In our study, Hep B/C was assessed collectively due to the small population size. SWE results showed that mean liver stiffness in F0–F1, F2, F3, and F4 stage fibrosis was 5.48 ± .52 kPa, 8.22 ± .42 kPa, 9.56 ± .32 kPa, and 12.41 ± 2.9kPa, respectively. A study evaluated the diagnostic value of SWE in Hep C and reported it as an excellent tool for detecting liver fibrosis (Tada et al., 2015). For determining the prognosis and treatment of fibrosis, it is important to determine its stage. The measure of liver stiffness predicts response to HCV treatment (Ali et al., 2018). SWE is a cost-effective, timesaving, reliable, non-invasive modality for assessing liver tissue donors. Our study had certain limitations. Firstly, various causes of liver diseases were studied, which may have caused heterogeneity in results; however, liver tissue elasticity and fibrosis stage were correlated, suggesting the procedure's validity for fibrosis measurement. Second, most of the sample had mild fibrosis, due to the advanced stage not being studied comprehensively.

Conclusion

It is concluded that shear wave elastography is a reliable non-invasive tool that can replace liver biopsy for assessing liver fibrosis.

Conflict of interest

The authors declare no conflict of interest.

References

Abraldes, J. G., Bureau, C., Stefanescu, H., Augustin, S., Ney, M., Blasco, H., Procopet,

[Citation: Zahra, M., Zafar, A., Khalid, A., Ahmed, R., Bukhari, A. (2022). Comparison of diagnostic value of shear wave elastography and liver biopsy in assessing liver fibrosis. *Biol. Clin. Sci. Res. J.*, **2022***: 162.* doi: https://doi.org/10.54112/bcsrj.v2022i1.162]

B., Bosch, J., Genesca, J., and Berzigotti, A. (2016). Noninvasive tools and risk of clinically significant portal hypertension and varices in compensated cirrhosis: The "Anticipate" study. *Hepatology***64**, 2173-2184.

Ali, Z. A., Zytoon, A. A., Elsakhawy, M. M., and Algamal, R. M. (2018). Real-time shear wave elastography for assessing liver fibrosis in patients with chronic hepatitis C. *Menoufia Medical Journal***31**, 538.

Augustin, S., Pons, M., Maurice, J. B., Bureau, C., Stefanescu, H., Ney, M., Blasco, H., Procopet, B., Tsochatzis, E., and Westbrook, R. H. (2017). Expanding the Baveno VI criteria for the screening of varices in patients with compensated advanced chronic liver disease. *Hepatology***66**, 1980-1988.

Barr, R. G., Wilson, S. R., Rubens, D., Garcia-Tsao, G., and Ferraioli, G. (2020). Update to the society of radiologists in ultrasound liver elastography consensus statement. *Radiology***296**, 263-274.

Berzigotti, A., Ferraioli, G., Bota, S., Gilja, O. H., and Dietrich, C. F. (2018). Novel ultrasound-based methods to assess liver disease: The game has just begun. *Digestive and liver disease***50**, 107-112.

Buchanan, R., and Sinclair, J. M. (2021). Alcohol use disorder and the liver. *Addiction***116**, 1270-1278.

Cassinotto, C., Lapuyade, B., Guiu, B., Des Grottes, H. M., Piron, L., Merrouche, W., Irles-Depe, M., Molinari, N., and De Ledinghen, V. (2020). Agreement between 2-dimensional shear wave and transient elastography values for diagnosis of advanced chronic liver disease. *Clinical Gastroenterology and Hepatology***18**, 2971-2979. e3.

Dietrich, C. F., Ferraioli, G., Sirli, R., Popescu, A., Sporea, I., Pienar, C., Kunze, C., Taut, H., Schrading, S., and Bota, S. (2019). General advice in ultrasound based elastography of pediatric patients. *Medical Ultrasonography***21**, 315-326.

Jang, W., Jo, S., Song, J. S., Hwang, H. P., and Kim, S.-H. (2021). Comparison of diffusion-weighted imaging and MR elastography in staging liver fibrosis: a meta-analysis. *Abdominal Radiology***46**, 3889-3907.

Kim, H.-s., and El-Serag, H. B. (2019). The epidemiology of hepatocellular carcinoma in the USA. *Current gastroenterology reports***21**, 1-8.

Mercedes, R., Brown, J., Minard, C., Tsai, C. M., Devaraj, S., Munden, M., and Leung, D. (2020). A liver biopsy validation pilot study of shear wave elastography, APRI, FIB-4, and novel serum biomarkers for liver fibrosis staging in children with chronic viral hepatitis. *Global Pediatric Health***7**, 2333794X20938931.

Miele, L., Zocco, M. A., Pizzolante, F., De Matthaeis, N., Ainora, M. E., Liguori, A., Gasbarrini, A., Grieco, A., and Rapaccini, G. (2020). Use of imaging techniques for non-invasive assessment in the diagnosis and staging of non-alcoholic fatty liver disease. *Metabolism***112**, 154355.

Monti, L., Salsano, M., Candusso, M., Avolio, A. W., Soglia, G., Marino, M., Francalanci, P., Spada, M., and Toma, P. (2020). Diagnosis of acute rejection of liver grafts in young children using acoustic radiation force impulse imaging. *American Journal of Roentgenology***215**, 1229-1237.

Popescu, A., Şirli, R., and Sporea, I. (2019). 2D shear wave elastography for liver fibrosis evaluation. *In* "Ultrasound Elastography". IntechOpen.

Tada, T., Kumada, T., Toyoda, H., Ito, T., Sone, Y., Okuda, S., Tsuji, N., Imayoshi, Y., and Yasuda, E. (2015). Utility of real-time shear wave elastography for assessing liver fibrosis in patients with chronic hepatitis C infection without cirrhosis: comparison of liver fibrosis indices. *Hepatology Research***45**, E122-E129.

[Citation: Zahra, M., Zafar, A., Khalid, A., Ahmed, R., Bukhari, A. (2022). Comparison of diagnostic value of shear wave elastography and liver biopsy in assessing liver fibrosis. *Biol. Clin. Sci. Res. J.,* **2022***: 162.* doi: https://doi.org/10.54112/bcsrj.v2022i1.162]