International Journal of Multidisciplinary and Current Educational Research (IJMCER)
ISSN: 2581-7027 ||Volume|| 4 ||Issue|| 3 ||Pages 49-52 ||2022||

Imaging diagnosis of hepatic cirrhosis (review)

Dr.Sh.M. Sander KOLA[1], Irena KOLA[2], Dr. Esmeralda THOMA[3], Dr.Erinda FRROKU[3],
1,2,3,4 University Hospital "Mother Teresa" Tirana

I. INTRODUCTION:

Cirrhosis of the liver is a chronic disease of the liver, which reduces liver function and gives numerous complications such as portal hypertension such as ascites, esophageal varices, hepatorenal syndrome, hepatic encephalopathy, increased incidence of hepatocellular carcinoma. Early diagnosis is important in the management of this disease The cause of hepatic cirrhosis is alcohol consumption, hepatitis C, B, liver steatosis. Micronodular cirrhosis is more common in alcoholic cirrhosis, hepatitis C. Macronodular cirrhosis, characteristic of Hepatitis B. Imaging diagnosis has enabled early detection of morphological changes in the liver using ultrasonography (US), computed tomography (CT), magnetic resonance imaging (MRI), elastography. Ultrasound is a safe and relatively inexpensive imaging diagnostic tool. The initial findings of hepatic fibrosis from the US are similar to simple hepatosteatosis. Studies show a sensitivity of 65% - 95% - 98% via US. The US has some limitations, so hepatic venous Echo Doppler and Contrast Echo are used using microbubbles that help measure blood flow time to the liver. However, these techniques do not accurately indicate the stage of hepatic fibrosis and hemodynamic coefficients. Therefore the use of Elastography by the US emerged as a reliable method to assess liver fibrosis.Elastography has some limitations; the rate of unreliable measurements is up to 20% and the rate of reliable measurements is reduced in obese patients and is not performed in patients with ascites.

CT is the most sensitive diagnostic tool, easily showing morphological changes of the liver and extra-hepatic manifestations associated with portal hypertension. CT has some limitations: radiation, use of contrast agents, limited scan coverage range. New technological developments have reduced the scanning time, increased the size of the detector, enabling a reduction of the radiation dose, expanding the scanning range.MRI has several advantages, including high-resolution images with excellent contrast. Conventional MRI is limited to diagnosing the early stages of liver fibrosis and is not suitable for disease staging.Magnetic resonance imaging (MRE) is an evolving technique that noninvasively determines liver fibrosis, which increases with the progression of fibrosis. MRE has a high sensitivity in detecting liver fibrosis, according to stages: 91% - 97% ≥ stage F2, 92% - 95% ≥ stage F3, and 98% -99% ≥ stage F4, examines the whole liver, with a lower sample error than with a biopsy; has high diagnostic accuracy compared to other imaging methods; results are not affected by hepatic steatosis, obesity and ascitesMRE has limitations such as: misinterpretation of the results from high iron overload in the liver; longer examination time; the need for dedicated installation equipment; lack of comparable studies between 1.5 Tesla MRI and 3.0 Tesla.

CONCLUSION: US remains a simple, non-invasive tool for diagnosing cirrhosis, elastography, is more widely used, although MRE is more accurate,

KEY WORDS: hepatic cirrhosis, US, MRI, CT, elastography

Cirrhosis of the liver is the final stage of chronic liver disease. It is known as an irreversible form of parenchymal fibrosis. Cirrhosis of the liver reduces the function of the liver and gives numerous complications caused by nodular regeneration and portal hypertension such as ascites, esophageal varices,, hepatorenal syndrome, hepatic encephalopathy. In addition, it increases the incidence of hepatocellular carcinoma [1]. Early diagnosis of liver cirrhosis is important in the management of this disease and depends on the surface of the fibrosis. [2,3] . The main cause of hepatic cirrhosis is alcohol consumption, hepatitis C, B and liver steatosis. Cirrhosis is divided into micronodular cirrhosis, most often encountered in chronic alcoholic cirrhosis, hepatitis C. Macronodular cirrhosis, characteristic of Hepatitis B.Microscopic changes are measured with METAVIR (F0: no fibrosis, F1: portal fibrosis without bridging fibrosis, F2: low fibrosis portal fibrosis, F3: connective fibrosis with architectural damage, F4: cirrhosis) [4]. Imaging diagnosis of cirrhosis has enabled early detection of morphological changes in the liver using ultrasonography (US), computed tomography (CT), and magnetic resonance imaging (MRI). To facilitate the early diagnosis of liver cirrhosis, texture analysis and elastography

were performed [5,6] Ultrasound is a safe and relatively inexpensive imaging tool that allows periodic check-ups in patients with chronic hepatitis. The initial findings of hepatic fibrosis from the US are similar to simple hepatosteatosis, while fibrosis of the hepatic parenchyma softens ray penetration, increases the echogenicity of the parenchyma. [7] .Studies showed that the US has an overall susceptibility to chronic liver disease of 65% - 95%, up to 98%. [8,9,10,11,12] .However, there are some limitations to the widespread use of this technique, so in cirrhosis, hepatic vein Doppler Echo is used which shows enlargement or narrowing of the hepatic veins and Contrast Echo using microbubbles that can help measure the time it takes for blood to pass through the liver. [13]. However, these studies did not show any significant correlation between the severity of hepatic fibrosis and hemodynamic coefficients. [14].

Hepatic elastography, also known as Fibroscan, is a test used to assess the presence or absence of liver fibrosis, or to identify damage caused by chronic diseases such as hepatitis, cirrhosis, steatosis.This is a quick examination, which can be done in a few minutes and is harmless because it is performed with ultrasound, requiring no needles or incisions. Liver elastography can also be used to diagnose disease, replacing classical biopsy.In addition to being used to diagnose and identify the severity of these conditions, this test can also be used to evaluate the success of treatment, in order to assess the improvement or loss of liver tissue. [15].Elastography using the US is widely recognized as a reliable method for assessing liver fibrosis. The principle of elastography is the cutting of the examined tissue, which causes a lesser strain on the hard tissues than on the soft ones.

Elastography has some limitations; the rate of unreliable measurements is reached up to 20%, the rate of reliable measurements is reduced in obese patients and can not be performed in patients with ascites [16,17]. CT is the most sensitive diagnostic tool for assessing hepatic morphological changes. CT easily shows changes in liver morphology and extra-hepatic manifestations associated with portal hypertension. Changes in size and volume distribution are easily visible on a CT scan. In the early stages, the liver may appear normal. . [18]. CT has some limitations: radiation, use of iodine contrast agents, and limited range of scan coverage. . [19,20]. However, new technological developments have reduced the scan time and increased the size of the detector, enabling a reduction in the radiation dose and expanding the scanning range.MRI has several advantages over other imaging techniques, including high-resolution, high-contrast images against other soft tissue lesions, and a range of different techniques that facilitate diagnostic evaluation of organ morphology, physiology, and function. . [21,22] .Conventional MRI is limited to diagnosing the early stages of liver fibrosis and is not suitable for disease staging. [23] Magnetic resonance elastography (MRE) is an evolving technique that noninvasively determines the hardness of the liver by analyzing the propagation of mechanical waves through the liver tissue. It is based on hardening of the hepatic parenchyma which increases with the progression of fibrosis.

One study showed that MRE has a high sensitivity in detecting liver fibrosis, according to stages: 91% and 97% for liver fibrosis ≥ stage F2, 92% and 95% for liver fibrosis ≥ stage F3, and 98% and 99% for liver fibrosis ≥ stage F4. [24,25,26,27,28] MRE has many advantages: (1) it can examine the entire liver, with a lower sample error than with a biopsy; (2) diagnostic accuracy compared to other imaging methods; (3) results are not affected by hepatic steatosis, obesity and ascites. . [29,30,31,32] However, some clinical limitations include: (1) misinterpretation of results due to high iron overload in the liver; (2) a longer examination time; (3) the need for dedicated installation equipment; (4) lack of comparable studies between 1.5 Tesla and 3.0 Tesla MRI machines. Therefore, an absolute definitive value for the diagnosis and classification of hepatic fibrosis has not been established. More research is needed. [33,34,35]

II. CONCLUSION

The development of new imaging modalities for the diagnosis of liver cirrhosis has led to the early and accurate diagnosis of liver cirrhosis. Currently, elastography, used to measure the stiffness and elasticity of the liver, is more widely used than texture analysis in the diagnosis of liver cirrhosis. Although MRE has diagnostic accuracy, the US remains a simple imaging tool in diagnosing cirrhosis. The non-inferior diagnostic ability, non-invasiveness, and relative cost-effectiveness of US elastography may enable it to be one of the most useful techniques for diagnosing cirrhosis of the liver.We expect standardization of elastography techniques so that quantitative parameters obtained from clinical systems from different vendors can yield similar results in the future.

REFERENCES

1. Massarrat S, Fallahazad V, Kamalian N. Clinical, biochemical and imaging-verified regression of hepatitis B-induced cirrhosis. *Liver Int.* 2004;24:105–109. [PubMed] [Google Scholar]

2. Ghany MG, Strader DB, Thomas DL, Seeff LB. Diagnosis, management, and treatment of hepatitis C: an update. *Hepatology.* 2009;49:1335–1374. [PMC free article] [PubMed] [Google Scholar]
3. Castera L. Invasive and non-invasive methods for the assessment of fibrosis and disease progression in chronic liver disease. *Best Pract Res Clin Gastroenterol.* 2011;25:291–303. [PubMed] [Google Scholar]
4. Ishak K, Baptista A, Bianchi L, Callea F, De Groote J, Gudat F, Denk H, Desmet V, Korb G, MacSween RN. Histological grading and staging of chronic hepatitis. *J Hepatol.* 1995;22:696–699. [PubMed] [Google Scholar]
5. Parkes J, Guha IN, Roderick P, Rosenberg W. Performance of serum marker panels for liver fibrosis in chronic hepatitis C. *J Hepatol.* 2006;44:462–474. [PubMed] [Google Scholar]
6. Grigorescu M. Noninvasive biochemical markers of liver fibrosis. *J Gastrointestin Liver Dis.* 2006;15:149–159. [PubMed] [Google Scholar]
7. Zardi EM, Caturelli E. May sonography distinguish between liver fibrosis and liver steatosis? *Dig Liver Dis.* 2007;39:790. [PubMed] [Google Scholar]
8. Colli A, Fraquelli M, Andreoletti M, Marino B, Zuccoli E, Conte D. Severe liver fibrosis or cirrhosis: accuracy of US for detection--analysis of 300 cases. *Radiology.* 2003;227:89–94. [PubMed] [Google Scholar]
9. Viganò M, Visentin S, Aghemo A, Rumi MG, Ronchi G. US features of liver surface nodularity as a predictor of severe fibrosis in chronic hepatitis C. *Radiology.* 2005;234:641; author reply 641. [PubMed] [Google Scholar]
10. Soresi M, Giannitrapani L, Cervello M, Licata A, Montalto G. Non invasive tools for the diagnosis of liver cirrhosis. *World J Gastroenterol.* 2014;20:18131–18150. [PMC free article] [PubMed] [Google Scholar]
11. Hartman PC, Oosterveld BJ, Thijssen JM, Rosenbusch GJ, van den Berg J. Detection and differentiation of diffuse liver disease by quantitative echography. A retrospective assessment. *Invest Radiol.* 1993;28:1–6. [PubMed] [Google Scholar]
12. Layer G, Zuna I, Lorenz A, Zerban H, Haberkorn U, Bannasch P, van Kaick G, Räth U. Computerized ultrasound B-scan texture analysis of experimental diffuse parenchymal liver disease: correlation with histopathology and tissue composition. *J Clin Ultrasound.* 1991;19:193–201. [PubMed] [Google Scholar]
13. Kok T, van der Jagt EJ, Haagsma EB, Bijleveld CM, Jansen PL, Boeve WJ. The value of Doppler ultrasound in cirrhosis and portal hypertension. *Scand J Gastroenterol Suppl.* 1999;230:82–88. [PubMed] [Google Scholar]
14. Tang A, Kim TK, Heathcote J, Guindi M, Jang HJ, Karshafian R, Burns PN, Wilson SR. Does hepatic vein transit time performed with contrast-enhanced ultrasound predict the severity of hepatic fibrosis? *Ultrasound Med Biol.* 2011;37:1963–1969. [PubMed] [Google Scholar]
15. Friedrich-Rust M, Ong MF, Martens S, Sarrazin C, Bojunga J, Zeuzem S, Herrmann E. Performance of transient elastography for the staging of liver fibrosis: A meta-analysis. *Gastroenterology.* 2008;134:960–974. [PubMed] [Google Scholar]
16. Sporea I, Sirli R, Deleanu A, Tudora A, Popescu A, Curescu M, Bota S. Liver stiffness measurements in patients with HBV vs HCV chronic hepatitis: a comparative study. *World J Gastroenterol.* 2010;16:4832–4837. [PMC free article] [PubMed] [Google Scholar]
17. Riggio S, Mamone F, Mandraffino G, Maimone S, Alibrandi A, Manti L, Saitta C, Tripodi PF, Sardo MA, Squadrito G, et al. Assessment of liver stiffness in subjects affected by familial combined hyperlipidaemia with hepatic steatosis. *Eur J Clin Invest.* 2010;40:722–728. [PubMed] [Google Scholar]
18. Chon YE, Choi EH, Song KJ, Park JY, Kim do Y, Han KH, Chon CY, Ahn SH, Kim SU. Performance of transient elastography for the staging of liver fibrosis in patients with chronic hepatitis B: a meta-analysis. *PLoS One.* 2012;7:e44930. [PMC free article] [PubMed] [Google Scholar]
19. Miles KA, Hayball MP, Dixon AK. Functional images of hepatic perfusion obtained with dynamic CT. *Radiology.* 1993;188:405–411. [PubMed] [Google Scholar]
20. Ronot M, Asselah T, Paradis V, Michoux N, Dorvillius M, Baron G, Marcellin P, Van Beers BE, Vilgrain V. Liver fibrosis in chronic hepatitis C virus infection: differentiating minimal from intermediate fibrosis with perfusion CT. *Radiology.* 2010;256:135–142. [PubMed] [Google Scholar]
21. Faria SC, Ganesan K, Mwangi I, Shiehmorteza M, Viamonte B, Mazhar S, Peterson M, Kono Y, Santillan C, Casola G, et al. MR imaging of liver fibrosis: Current state of the art. *RSNA.* 2009;29:1615–1635. [PMC free article] [PubMed] [Google Scholar]

22. Annet L, Peeters F, Abarca-Quinones J, Leclercq I, Moulin P, Van Beers BE. Assessment of diffusion-weighted MR imaging in liver fibrosis. *J Magn Reson Imaging.* 2007;25:122–128. [PubMed] [Google Scholar]
23. Sandrasegaran K, Akisik FM, Lin C, Tahir B, Rajan J, Saxena R, Aisen AM. Value of diffusion-weighted MRI for assessing liver fibrosis and cirrhosis. *AJR Am J Roentgenol*. 2009;193:1556–1560. [PubMed] [Google Scholar]
24. Wang Y, Ganger DR, Levitsky J, Sternick LA, McCarthy RJ, Chen ZE, Fasanati CW, Bolster B, Shah S, Zuehlsdorff S, et al. Assessment of chronic hepatitis and fibrosis: comparison of MR elastography and diffusion-weighted imaging. *AJR Am J Roentgenol*. 2011;196:553–561. [PMC free article] [PubMed] [Google Scholar]
25. Yin M, Talwalkar JA, Glaser KJ, Manduca A, Grimm RC, Rossman PJ, Fidler JL, Ehman RL. Assessment of hepatic fibrosis with magnetic resonance elastography. *Clin Gastroenterol Hepatol*. 2007;5:1207–1213.e2. [PMC free article] [PubMed] [Google Scholar]
26. Zou LQ, Chen J, Pan L, Jiang JZ, Xing W. Comparison of magnetic resonance elastography and diffusion-weighted imaging for staging hepatic fibrosis. *Chin Med J (Engl)* 2015;128:620–625. [PMC free article] [PubMed] [Google Scholar]
27. Rustogi R, Horowitz J, Harmath C, Wang Y, Chalian H, Ganger DR, Chen ZE, Bolster BD, Shah S, Miller FH. Accuracy of MR elastography and anatomic MR imaging features in the diagnosis of severe hepatic fibrosis and cirrhosis. *J Magn Reson Imaging.* 2012;35:1356–1364. [PMC free article] [PubMed] [Google Scholar]
28. Chamarthi SK, Raterman B, Mazumder R, Michaels A, Oza VM, Hanje J, Bolster B, Jin N, White RD, Kolipaka A. Rapid acquisition technique for MR elastography of the liver. *Magn Reson Imaging.* 2014;32:679–683. [PMC free article] [PubMed] [Google Scholar]
29. Yoon JH, Lee JM, Joo I, Lee ES, Sohn JY, Jang SK, Lee KB, Han JK, Choi BI. Hepatic fibrosis: prospective comparison of MR elastography and US shear-wave elastography for evaluation. *Radiology.* 2014;273:772–782. [PubMed] [Google Scholar]
30. Aguirre DA, Behling CA, Alpert E, Hassanein TI, Sirlin CB. Liver fibrosis: noninvasive diagnosis with double contrast material-enhanced MR imaging. *Radiology*. 2006;239:425–437. [PubMed] [Google Scholar]
31. Nilsson H, Nordell A, Vargas R, Douglas L, Jonas E, Blomqvist L. Assessment of hepatic extraction fraction and input relative blood flow using dynamic hepatocyte-specific contrast-enhanced MRI. *J Magn Reson Imaging.* 2009;29:1323–1331. [PubMed] [Google Scholar]
32. Ryeom HK, Kim SH, Kim JY, Kim HJ, Lee JM, Chang YM, Kim YS, Kang DS. Quantitative evaluation of liver function with MRI Using Gd-EOB-DTPA. *Korean J Radiol*. 2004;5:231–239. [PMC free article] [PubMed] [Google Scholar]
33. Watanabe H, Kanematsu M, Goshima S, Kondo H, Onozuka M, Moriyama N, Bae KT. Staging hepatic fibrosis: comparison of gadoxetate disodium-enhanced and diffusion-weighted MR imaging--preliminary observations. *Radiology.* 2011;259:142–150. [PubMed] [Google Scholar]
34. Jeong JY, Kim TY, Sohn JH, Kim Y, Jeong WK, Oh YH, Yoo KS. Real time shear wave elastography in chronic liver diseases: accuracy for predicting liver fibrosis, in comparison with serum markers. *World J Gastroenterol.* 2014;20:13920–13929. [PMC free article] [PubMed] [Google Scholar]
35. Venkatesh SK, Wang G, Lim SG, Wee A. Magnetic resonance elastography for the detection and staging of liver fibrosis in chronic hepatitis B. *Eur Radiol*. 2014;24:70–78. [PubMed] [Google Scholar]