# Alternatives to liver biopsy for the detection of liver cirrhosis.

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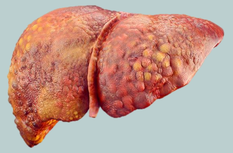

Figure 1. Liver Cirrhosis (liver scaring)

## Introduction

Liver cirrhosis (LC), the damage of liver tissue often found in combination with progressive stages of a plethora of diseases and etiologies such as chronic liver disease (CLD) and . LC involves the change in liver tissue structure from normal functioning tissue to fibrotic tissue. This fibrotic – abnormal architecture of liver tissue includes annular fibrosis enclosing abnormal nodules. The extent of tissue exchange from normal to diseased tissue determines the severity of cirrhosis. There are various metrics used to stage the severity. Some of these include: Histology Activity Index (HAI), Brunt, METAVIR, Sheuer and Ishak are among the most common.

The prognosis and management of chronic liver diseases depend on the degree of liver fibrosis. Therefore, the assessment of liver fibrosis provides useful information not only for diagnosis but also for treatment planning. Although liver biopsy is still the gold standard for assessing hepatic fibrosis, it has some technical limitations and risks. Furthermore, the dynamic process of liver fibrosis resulting from progression and regression cannot be quantified by liver biopsy. Therefore, alternative, simple, reliable and noninvasive tests are needed to assess the stage of fibrosis. Several noninvasive direct and indirect serum markers able to predict the presence of significant fibrosis or cirrhosis in patients with chronic liver disease have been identified and tested and they found considerable accuracy. However, since most of these markers require complicated calculations, clinical application is difficult.

## Current method - Biopsy

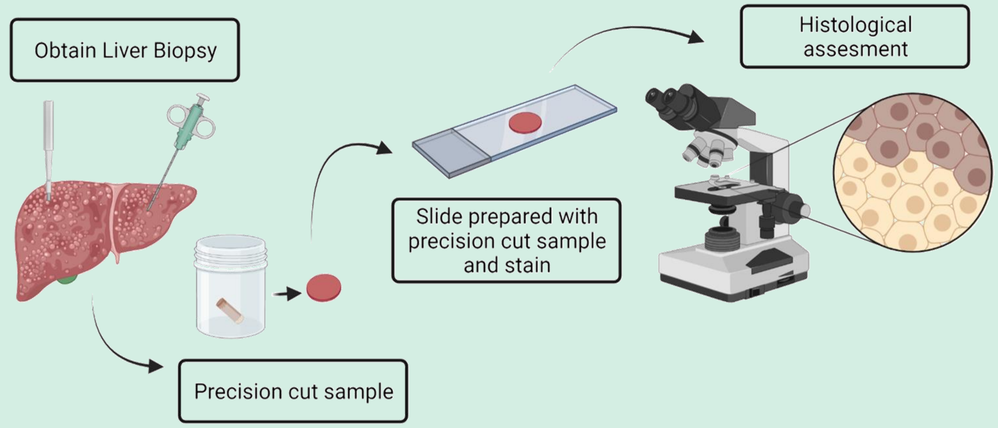


Figure 2. Simplified overview of the liver biopsy process.

## Serum markers

Certain serological tests can be used as a way of detecting LC – using serum markers.

Serum markers of liver fibrosis are popular where training is available due to generally offering a cost-effective alternative to liver biopsy, they are less invasive and theoretically without complications. Thanks to these features they could therefore be performed repeatedly and used in monitoring the fibrotic process dynamically.

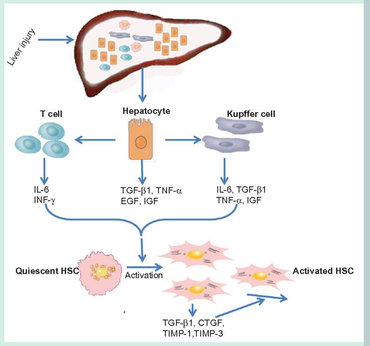


Figure 3. the process of serum markers being released.

## TE (FibroScan TM® EchoSensTM)

Figure 4. Portable model of the FibroScan TM machine.

- M ultrasound probe (5 MHz) with a dedicated vibrating system
- It produces mechanical waves with a low frequency and amplitude (50 MHz).
- The waves generated come back to the transducer mounted on the end of the probe,
- The transducer functions as both a generator and receiver.
- This way the shear wave velocity measured (in meters per second) can then be converted into liver stiffness.

## Elastography

In the last two decades new diagnostic tools have been developed which, when supported by ultrasound, permit the estimation of fibrosis. They are based on the hypothesis that fibrosis in a given tissue determines a reduction in elasticity or an increase in stiffness.

During the course of chronic hepatitis, the liver becomes more fibrotic and its stiffness therefore increases. This may be recorded by transient elastometry (TE), which measures the degree of stiffness using ultrasounds. TE is therefore the equivalent of palpation, and for this reason it has been defined “palpation imaging”.

Two concepts are fundamental for elastography: (1) the evaluation of strain which deforms the tissue (due to a force that deforms the tissue) namely static or quasi-static methods, which are defined as strain imaging techniques; and (2) the speed analysis of a shear wave induced by a mechanical vibrator or other techniques, is defined as the shear-wave technique.

The stiffer a tissue is, the higher the propagation speed of US waves will be; their evaluation will allow an estimation of stiffness.

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