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EDITORIAL COMMENT

Stone Liver, Heart in Danger

Could the Liver Stiffness Assessment Improve the Management of Patients With Heart Failure?*

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Estimating prognosis is particularly challenging in patients with heart failure (HF). It is the cardiac disease with the highest rate of hospitalization (and hence the cost) in North American countries (1). Many clinical tools have been developed to better understand and treat this disease. Whether through cardiac catheterization, biological parameters, or imaging techniques, most of these tools have focused on the assessment of the heart function and structure. Rare have been the leads conducting to an indirect analysis, based on "collateral" information provided by imaging biomarkers of other organs.

Nevertheless, it is now accepted by the cardiological community that the liver plays a major role in the prognosis of patients with HF, regardless of its mechanism or etiology (2). As with the ultrasound imaging techniques recently used to better understand the functioning of the left heart (tissue Doppler imaging, strain imaging, 3- or 4-dimensional volumetric acquisitions), the development of techniques allowing the understanding of the right heart seems now to be essential. The paradox is that every clinician knows that right heart scanning by echocardiography can be technically more complicated than left heart analysis, mainly because of the acoustic windows and the anatomical situation of the right heart (just behind the sternum). We need therefore to explore new ideas to understand how patients' right heart work. The liver, directly connected to the right heart by the hepatic veins and the inferior vena cava, is an ally of choice for the cardiologist who still lacks the tools to analyze the heart autonomously and at the patient's bed.

For the past 15 years, ultrasound elastography (3) has made it possible to quantify accurately and noninvasively liver stiffness (LS), whether by external mechanical stimulus used in the Fibroscan, or by remote palpation used by other shear wave elastography techniques. Initially developed to better diagnose liver fibrosis, some confounding factors (**Figure 1**) such as cardiac congestion initially hindered radiologists or hepatologists (4). Then they eventually took advantage of it. Indeed, Millonig et al. was the first study to quantify the dependence of LS with central venous pressure (CVP) and LS on an animal model (5). Understanding the filling pressures of the right heart with the analysis of hepatic congestion made sense. Before elastography, the clinician had to palpate the liver and make a subjective analysis. With elastography, the clinician now has an objective and noninvasive tool for quantitatively analyzing LS. Subsequently, and logically, other teams have sought to demonstrate directly on human subjects that this CVP/LS relationship was applicable, whether in adults (6) or children (7–9) in a population with a healthy hepatic parenchyma.

In this issue of *iJACC*, Taniguchi et al. (10) go 1 step forward and demonstrate the prognostic value of LS in patients with HF. This study follows their previous work published in 2014, which established a direct link between CVP and LS in a population of patients with HF (6). This new study was carried out prospectively on 171 patients and Taniguchi et al. (10) provide very strong arguments about the interest of analyzing LS in these patients. In particular, the authors show that LS is associated to the severity of HF, and that LS is a strong predictor of clinical outcomes. In contrast to the studies cited previously, this new study makes it possible to find direct clinical interest in the use of LS in this population. Moreover, one of the main strengths of LS is summarized in the methodology of this study: the authors performed only 1

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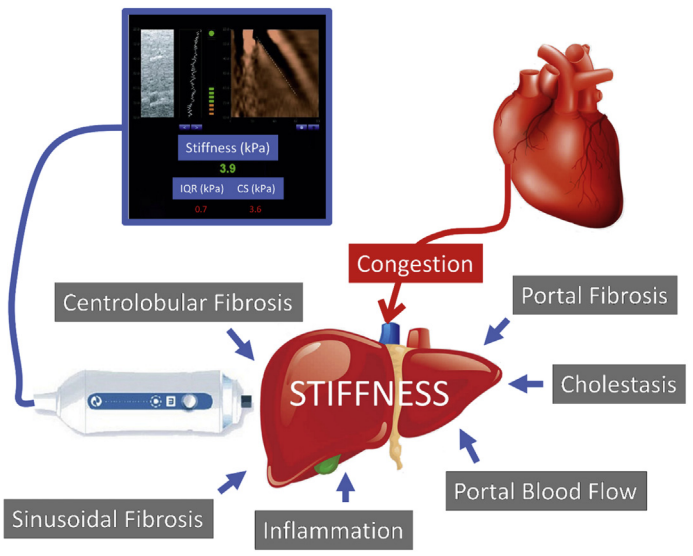
FIGURE 1 Confounding Factors of Liver Stiffness



Many factors affect liver stiffness, which can be estimated noninvasively by transient elastography (Fibroscan). CS = current stiffness; IQR = interquartile range.

analysis of LS per patient, at discharge, and were able to glean numerous clinically significant results. This reminds us of the simplicity of using this imaging tool: it is done at the patient's bed, in a short time, and can be carried out by any doctor or specialist nurse practitioner.

As with any new diagnostic tool, it is essential to understand its limits. We believe **Figure 1** summarizes the remaining barriers to LS for widespread application in cardiology. As such, Taniguchi et al. (10) have paid particular attention in selecting their populations. Their objective was to analyze specifically cardiac congestion through LS. It was therefore necessary to "exclude" all other parameters that could affect LS (4). For this reason, 37 patients, initially included, had to be excluded from the study because of organic hepatic disease. Again, and in a very rigorous manner, the authors state in their Discussion and Study sections that the link between CVP and LS was "conceivable," but not certain. In summary, despite an irreproachable methodology, genuine clarity, and honesty in the discussion of their results, Taniguchi et al. (6) make the effort to recall that LS does not directly provide CVP quantitatively, in particular using the equation established in their previous study.

There is a long way to go for LS to become a reliable and reproducible tool for the cardiologist. But this study, by virtue of the authors' experience in the field and by the importance of their methodological rigor, is a big step forward in understanding the clinical usefulness of LS. The cardiologist also needs to know the limitations, however, to apply and interpret accurately this new diagnostic tool.

The higher the LS, the greater the risk patient death. *Stone liver, heart in danger* is, in a way, the message of this work. But future clinical studies may tell us whether decreasing LS can improve the prognosis of patients with HF. And in this case, we will have new and valuable arguments for implementing therapeutic strategies to reduce hepatic congestion monitored by elastography, which will change our clinical practice. Thanks to the liver, we could have the means to better understand the right heart.

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