

**Liver stiffness is associated with congestion by bioimpedance vector analysis in patients with decompensated heart failure**

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**Objective:** Over the last several years the relationship of liver stiffness (LS) with congestion in decompensated heart failure (DHF) have been discussed. We investigated LS by the transient elastography (TE) and its associations with hydration status assessed by bioimpedance vector analysis (BIVA) and weight dynamics in patients with DHF.

**Methods:** LS was measured using TE in 94 patients with DHF on admission and discharge (60 male, 72±10 years (M±SD), arterial hypertension 96%, myocardial infarction 55%, atrial fibrillation (AF) 63%, diabetes mellitus 45%, known chronic kidney disease 29%, chronic anaemia 30%, left ventricular ejection fraction (EF) 40±14%, EF <40% 28%, NYHA IV 41%). Ten valid measurements were required with success rate of >60%. LS≤5.8 was considered normal and LS ≥5.9, 7.2, 9.5 and 12.5 kPa were considered fibrosis (F1-F3 METAVIR score) and cirrhosis (F4) according to thresholds in studies with chronic liver disease.

Hydration status was assessed by BIVA using resistance (R) and reactance (Xc), standardized by height (h). Results have been graphically depicted. Deviation from the 50th, 75th and 95th vector percentile of the healthy reference population was considered as mild, moderate and severe hyperhydration. Mann-Whitney test, Wilcoxon test, Spearman correlation tests were performed. P<0.05 was considered significant.

**Results:** Normal LS was observed in 16% of patients. Abnormal LS ≥5.9, 7.2, 9.5 and 12.5 kPa occurred in 8.5, 14, 10.5 and 51% of patients respectively. Mild, moderate and severe hyperhydration were revealed in 23, 34 and 43% of patients respectively.

In patients with mild, moderate and severe hyperhydration by BIVA the median LS was 6.1 (4.4; 18.4), 14.8 (11.4; 21.7) and 17.5 (12.3; 34.3) kPa, p<0,05. In patients with LS <5.6, ≥5.9, 7.2, 9.5 and 12.5 kPa parameters R/h and Xc/h were 314±76 and 28±6, 286±64 and 25±4, 277±41 and 26±10, 239±41 and 20±5, 235±55 and 18±6 Om/m, respectively. Decrease of R/h and Xc/h means increase of severity of hyperhydration.

Statistically significant correlations between LS and BIVA parameters of hyperhydration on admission were revealed (r=-0.32 for R/h and r=-0.37 for Xc/h, p<0.05).

During hospitalisation the following changes were observed: the median value of LS decreased from 17.1 (interquartile range 10.2; 34.8) to 11.6 (6.4; 19.6) kPa ( $\Delta$ LS=-5.5 (-12;-0.1) kPa), p<0.001. R/h and Xc/h increased from 242±55 to 286±59 Om/m and from 19±5 to 23±6 Om/m ( $\Delta$ R/h 25 (10; 72) Om/m,  $\Delta$ Xc/h 4.4 (1.1; 7.5) Om/m), p<0.001 for both comparisons. Patients weight decreased from 89±23 to 79±20 kg, p<0.001 ( $\Delta$ weight -5.4±4.8).  $\Delta$ LS was negatively correlated with  $\Delta$  R/h (r=-0.48),  $\Delta$ Xc/h (r=-0.46) and  $\Delta$  weight (r=-0.54).

**Conclusions:** LS was associated with congestion by BIVA. During hospitalization absolute decrease of LS correlated with absolute decrease of weight and increase of BIVA parameters.

