

Noninvasive hematocrit assessment for cardiovascular magnetic resonance extracellular volume quantification using a point-of-care device and synthetic derivation.

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BACKGROUND: Calculation of cardiovascular magnetic resonance (CMR) extracellular volume (ECV) requires input of hematocrit, which may not be readily available. The purpose of this study was to evaluate the diagnostic accuracy of ECV calculated using various noninvasive measures of hematocrit compared to ECV calculated with input of laboratory hematocrit as the reference standard.

METHODS: One hundred twenty three subjects (47.7 ± 14.1 years; 42% male) were prospectively recruited for CMR T1 mapping between August 2016 and April 2017. Laboratory hematocrit was assessed by venipuncture. Noninvasive hematocrit was assessed with a point-of-care (POC) device (Pronto-7[®] Pulse CO-Oximeter[®], Masimo Personal Health, Irvine, California, USA) and by synthetic derivation based on the relationship with blood pool T1 values. Left ventricular ECV was calculated with input of laboratory hematocrit (Lab-ECV), POC hematocrit (POC-ECV), and synthetic hematocrit (synthetic-ECV), respectively. Statistical analysis included Wilcoxon signed-rank test, Bland-Altman analysis, receiver-operating curve analysis and intra-class correlation (ICC).

RESULTS: There was no significant difference between Lab-ECV and POC-ECV ($27.1 \pm 4.7\%$ vs. $27.3 \pm 4.8\%$, $p = 0.106$), with minimal bias and modest precision (bias - 0.18%, 95%CI [- 2.85, 2.49]). There was no significant difference between Lab-ECV and synthetic-ECV ($26.7 \pm 4.4\%$ vs. $26.5 \pm 4.3\%$, $p = 0.084$) in subjects imaged at 1.5 T, although bias was slightly higher and limits of agreement were wider (bias 0.23%, 95%CI [- 2.82, 3.27]). For discrimination of abnormal Lab-ECV $\geq 30\%$, POC-ECV had good diagnostic performance (sensitivity 85%, specificity 96%, accuracy 94%, and AUC 0.902) and synthetic-ECV had moderate diagnostic performance (sensitivity 71%, specificity 98%, accuracy 93%, and AUC 0.849). POC-ECV had excellent test-retest (ICC 0.994, 95%CI[0.987, 0.997]) and inter-observer agreement (ICC 0.974, 95%CI[0.929, 0.991]).

CONCLUSIONS: Myocardial ECV can be accurately and reproducibly calculated with input of hematocrit measured using a noninvasive POC device, potentially overcoming an important barrier to implementation of ECV. Further evaluation of synthetic ECV is required prior to clinical implementation.