

Detection of left ventricular systolic dysfunction by segmental impedance plethysmography during routine 12 lead ECG screening

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Objective

Early diagnosis of impaired left ventricular systolic function may impact the course of the disease and the prognosis. We aimed to determine whether segmental impedance plethysmography, using and extending the electrodes of a conventional electrocardiography system, can detect a moderate to severe reduction of left ventricular ejection fraction.

Methods

We investigated patients with chronic heart failure as well as healthy controls, using segmental impedance plethysmography, inbuilt in a regular electrocardiography device (Combyn[®], www.ac-tc.at, Graz, Austria). Parameters assessed included the area under the curve of the impedance signal measured at different parts of the body (thorax, arms, legs), specifically from the thorax (area-TH); and the time from the R wave to the beginning of the impedance signal from different parts of the body (thorax, arms, legs), specifically to the left arm (time R-LA). Comparator was left ventricular ejection fraction (LVEF), assessed by echocardiography using the biplane Simpson method.

Statistics used was receiver-operating-curve (ROC) analysis for calculation of the area under the curve (AUC) for discrimination between normal/mildly reduced (> 45%) and moderately/severely reduced (< 45%) EF.

Results

Overall, 75 participants were included, 92% of them were male, mean age was 55.9 years. The prevalence of arterial hypertension, diabetes and coronary artery disease was 32%, 23% and 35%, respectively. Mean LVEF was 39 % (ranging from 9% to 75%), and EF was moderately/severely reduced in 71% of the patients.

Using ROC analysis, AUC for detection of moderate/severe reduction of EF was 0.841 (95% CI 0.739- 0.916, p-value <0.0001) for area-TH, and 0.807 (95% CI 0.700-0.889, p-value<0,0001) for time R-LA. In comparison, AUC was 0.899 (95% CI 0.806-0.957) for NT-proBNP (Figure). Based on z-statistics, both segmental plethysmography-based AUCs were not statistically different (p=0.38 and p=0.17, respectively) from NT-proBNP based AUC.

Conclusion

Moderate to severe reduction of LVEF can be reliably detected by segmental impedance plethysmography during routine 12 lead ECG tracing. This method may serve as a screening tool for systolic heart failure when echocardiography is not easily available.

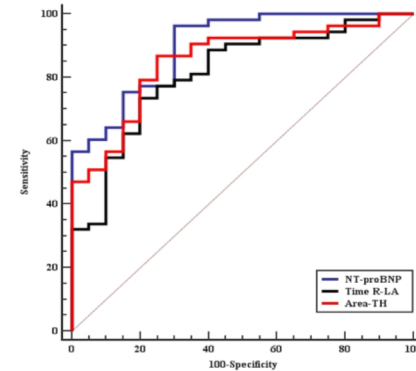


Figure: Diagnostic performance of segmental impedance plethysmography-based measures (Time R-LA and Area-TH) and nt-proBNP to detect moderately and severely impaired LVEF. Based on z-statistics, there was no significant differences between AUCs.