Left atrioventricular coupling index to predict incident heart failure: the multi-ethnic study of atherosclerosis (MESA)

Pezel T.1; Ambale Venkatesh B.1; Kato Y.2; De Vasconcellos H.1; Heckbert S.3; Wu C.1; Post W.1; Bluemke D.4; Cohen Solal A.2; Henry P.2; Lima J.1

1The Johns Hopkins Hospital, Division of Cardiology, Baltimore, United States of America
2Hospital Lariboisiere, Paris, France
3University of Washington, Department of Epidemiology, Seattle, United States of America
4University of Wisconsin-Madison, Medicine and Public Health, Madison, United States of America

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BACKGROUND: Although left atrial (LA) and left ventricular (LV) structural and functional parameters have independent prognostic value as predictors of HF, the close physiological relationship between LA and LV suggest that the assessment of LA/LV coupling could better reflect left atrioventricular dysfunction and be a better predictor of heart failure (HF).

PURPOSE: We investigated the prognostic value of a left atrioventricular coupling index (LACI), measured by cardiovascular magnetic resonance (CMR), as well as change in LACI to predict incident HF in the Multi-Ethnic Study of Atherosclerosis (MESA).

METHODS: In the MESA, 2,250 study participants, free of clinically recognized HF and cardiovascular disease at baseline, had LACI assessed by CMR imaging at baseline (Exam 1, 2000–2002), and ten years later (Exam 5, 2010–2012). LACI was defined as the ratio of LA to LV end-diastolic volumes. Univariable and multivariable Cox proportional hazard models were used to evaluate the associations of LACI and average annualized change in LACI (ΔLACI) with incident HF after adjustment on traditional HF risk factors. The incremental risk prediction was calculated using C-statistic, categorical net reclassification index (NRI) and integrative discrimination index (IDI).

RESULTS: Among the 2,250 participants (mean age 59.3 ± 9.3 years and 47.6% male participants), 50 incident HF events occurred over 6.8 ± 1.3 years after the second CMR exam. After adjustment, greater LACI and ΔLACI were independently associated with HF (adjusted HR 1.44, 95% CI [1.25-1.66] and adjusted HR 1.55, 95% CI [1.30-1.85], respectively; both p < 0.0001). Adjusted models for LACI showed significant improvement in model discrimination and reclassification compared to currently used HF risk score model for predicting HF incidence (C-statistic: 0.81 vs. 0.77; NRI = 0.411; IDI = 0.043). After adjustment, ΔLACI showed also significant improvement in model discrimination compared to the multivariable model with traditional HF risk factors for predicting incident HF (C-statistic: 0.82 vs. 0.77; NRI = 0.491; IDI = 0.058).

CONCLUSIONS: In a multi-ethnic population, atrioventricular coupling (LACI) and coupling change (ΔLACI) are independently associated with incident HF. Both have incremental prognostic value for predicting HF over traditional HF risk factors.

Abstract Figure. Survival curves for LACI to predict HF
Abstract Figure. Survival curves for Change in LACI

A

Cumulative incidence of RE (%)  

Log-rank p-value = 0.001

Years of follow-up

B

Cumulative incidence of RE (%)  

HR = 8.47 (2.57-7.79)  

p < 0.001

Years of follow-up

Number of RE

LAC I ≤ 39.7%  
LAC I 39.7 - 28.5%  
LAC I > 28.5%

750 749 738 722 725 690 644 287
750 746 739 726 715 690 632 264
750 740 724 704 686 659 605 236

1571 1565 1567 1517 1489 1465 1332 606
679 669 654 635 617 594 549 211

HR = 4.32 (1.96-5.97)  

p < 0.001

Years of follow-up

Number of RE

ΔLAC I ≤ 0.4%/year  
ΔLAC I > 0.4%/year  
ΔLAC I > 1.3%/year

750 749 738 722 709 689 638 282
750 741 728 711 687 670 615 263

1627 1620 1597 1565 1531 1489 1378 600
623 615 604 587 575 550 503 217