

Stratificazione del rischio aritmico nel paziente con scompenso a disfunzione moderata

PLACE 26 Giugno 2026
- Dr Luca Rossi -



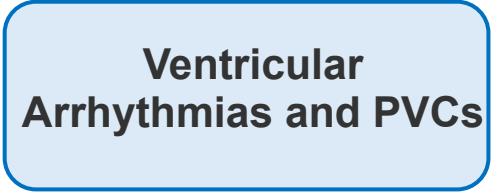
ICMs in Heart Failure with midly reduced EF: **why?**

**Worsening HF
prevention**

**Arrhythmia Risk
Stratification**

ICMs in Heart Failure: **what can we search?**

**Ventricular
Arrhythmias and PVCs**



The VIP-HF study shows that use of an ILR led to an increased number of patients in whom non-sustained ventricular tachyarrhythmias was detected (from 18% on baseline 24h Holter monitoring to 27%).

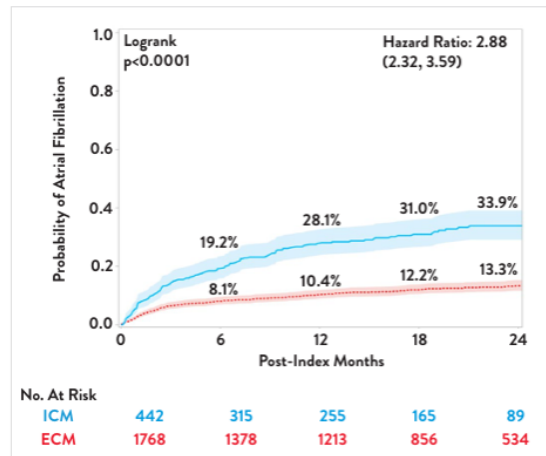
ICMs in Heart Failure: what can we search?

Atrial Arrhythmias

Patient with FA most likely develop HF instead of patient without AF. In HF patients, AF events influence prognosis and deteriorate HF status

MAIN RESULT

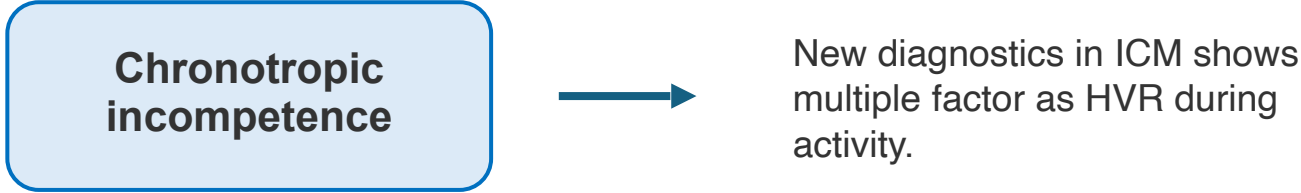
New AF Diagnosis in ICM vs ECM Patients



2-year AF incident rates estimated using the Kaplan Meier method. Hazard ratios (HR) estimated by cox proportional hazard models are also shown.

ICMs in Heart Failure: **what can we search?**

**Chronotropic
incompetence**



New diagnostics in ICM shows multiple factor as HVR during activity.

ICMs in Heart Failure: PVC



R-R Interval Sequence

- Detects beats with premature coupling interval, which accounts for fluctuations in heart rate and EGM signal amplitude.



Activates QRS Morphology Comparison

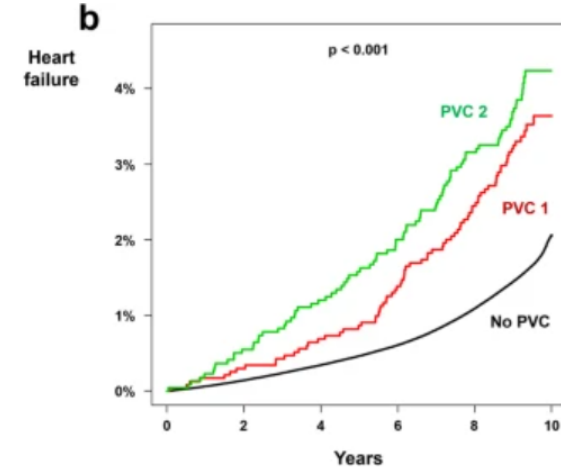
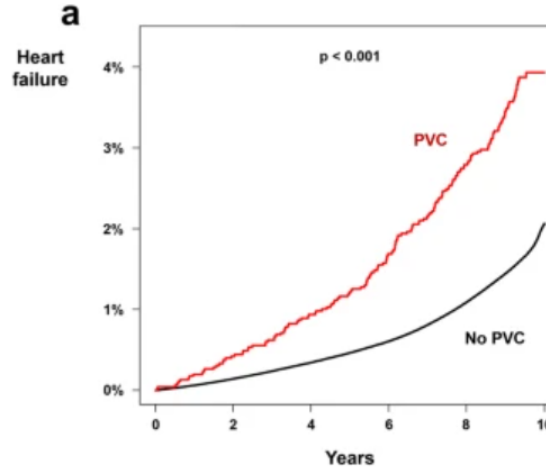
- Distinguishes between rapid irregular conduction (e.g., AF with RVR) and true PVCs.
- Uses area under the curve, peak amplitudes, and polarity changes to identify beats that are significantly different from intrinsic beats and classify them as PVCs.



PVC detection algorithms offers the ability to capture consecutive events, including couplets and triplets^b.

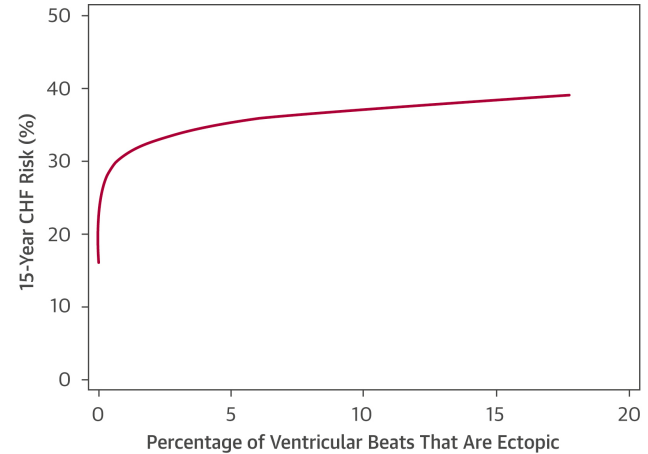
ICMs in Heart Failure: PVC

- **Incidence of PVCs** People with newly diagnosed PVC had a significantly higher incidence of heart failure compared to those without PVC [adjusted hazard ratio (HR) 1.371; 95% confidence interval (CI) 1.177–1.598; $p < 0.001$].



ICMs in Heart Failure: PVC

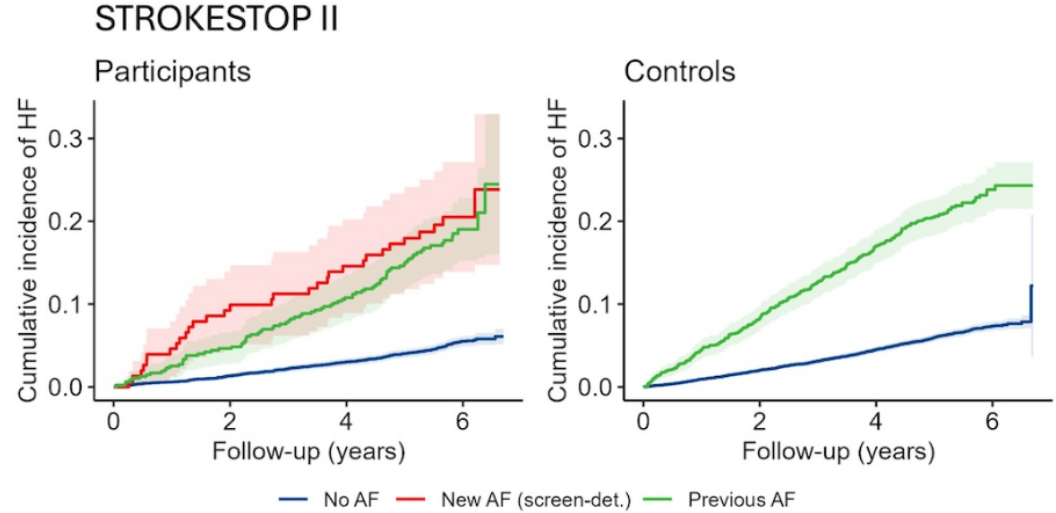
- **Incidence of PVCs** Those in the upper quartile versus the lowest quartile of PVC frequency had a multivariable-adjusted, 3-fold greater odds of a 5-year decrease in LVEF, a 48% increased risk of incident CHF, and a 31% increased risk of death during a median follow-up of >13 years.



Percent PVC count	15-Year CHF Risk	PPV	NPV	Sensitivity	Specificity
0%	16.2%	27.5%	100%	100%	0.2%
0.01%	19.3%	29.6%	78.5%	78.9%	29.1%
0.1%	25.2%	33.9%	75.7%	41.0%	69.7%
0.5%	29.0%	41.1%	75.0%	23.1%	87.5%
1.0%	30.8%	45.1%	74.5%	16.3%	92.5%
1.5%	31.9%	50.8%	74.3%	13.1%	95.2%
3.0%	33.8%	52.5%	73.7%	8.4%	97.1%
6.0%	35.7%	44.4%	72.9%	3.2%	98.5%
10.0%	37.2%	40.0%	72.6%	0.8%	99.5%
17.7%	36.4%	0%	72.5%	0.0%	100%

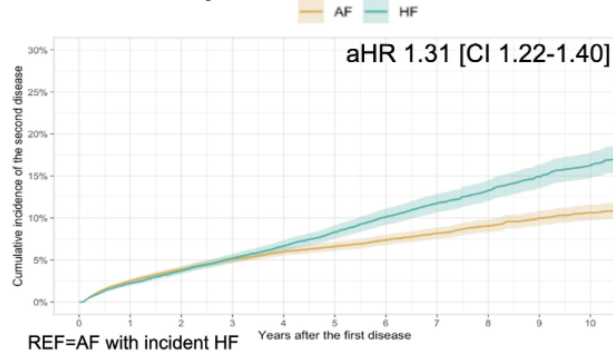
ICMs in Heart Failure: Atrial fibrillation

- **Incidence of AF** a postdoc analysis of STROKESTOP and STROKESTOP II shows that patient with FA most likely develop HF instead of patient without AF.



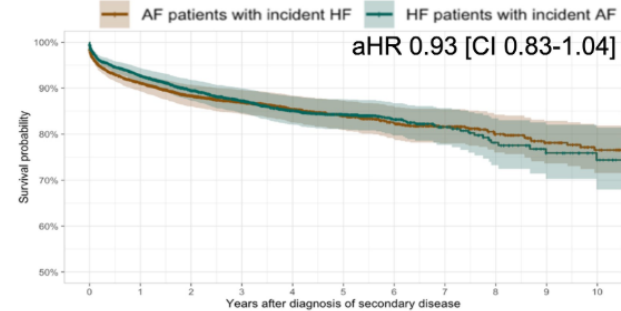
ICMs in Heart Failure: **Atrial fibrillation**

Temporality of Incidence



HF patients have a 31% increased risk to develop AF

Temporality of Mortality



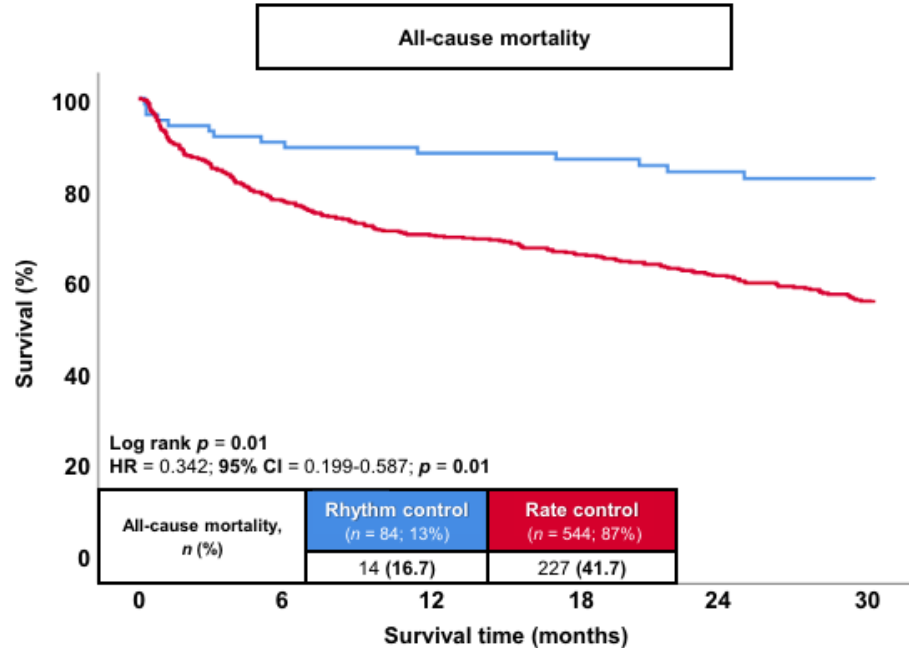
AF with incident HF have a 4-fold increased mortality risk
HF with incident AF have a 2.3-fold increased mortality risk

The increased risk of developing AF in HF patients, and vice versa, along with higher mortality when both coexist, highlights the need for secondary prevention

Arietje J et al. Development of Atrial Fibrillation in patients with Heart Failure and vice versa: Incidence, risk factors, and their impact on survival, *ESC Heart Failure*, 2026

ICMs in Heart Failure: Atrial fibrillation

- **Risk of mortality** are lower for rhythm control strategy compared to a rate control strategy.



ICMs in Heart Failure: Atrial fibrillation

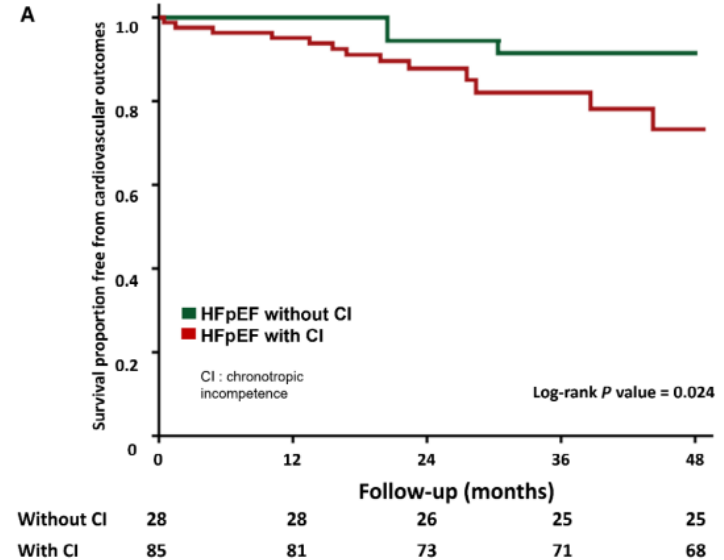
Rhythm Control Versus Rate Control in Patients With Atrial Fibrillation and Heart Failure With Preserved Ejection Fraction: Insights From Get With The Guidelines-Heart Failure

Jacob P Kelly¹, Adam D DeVore¹, JingJing Wu¹, Bradley G Hammill¹, Abhinav Sharma^{1 2}, Lauren B Cooper^{1 3}, G Michael Felker¹, Jonathan P Piccini¹, Larry A Allen⁴, Paul A Heidenreich⁵, Eric D Peterson¹, Clyde W Yancy⁶, Gregg C Fonarow⁷, Adrian F Hernandez¹

- **Rhythm control strategy** compared to a rate control strategy was associated with a lower risk of mortality in patients with HFpEF2. **Early diagnosis of AF could improve the timing of the start of a rhythm control strategy**

ICMs in Heart Failure: Chronotropic Incompetence

- In HFpEF, chronotropic incompetence is associated with elevated filling pressures, impaired ventilatory efficiency, and reduced exercise capacity, contributing to hospitalization for HF and cardiovascular death.
- Recognizing chronotropic incompetence may help predict poor prognosis in HFpEF.



ICMs in Heart Failure with midly reduced EF: **why?**

Worsening HF
prevention

Arrhythmia Risk
Stratification

- Heart failure patients who may benefit from the implementation of the loop recorder are clearly **those in which there is no indication for an ICD or PMK.**

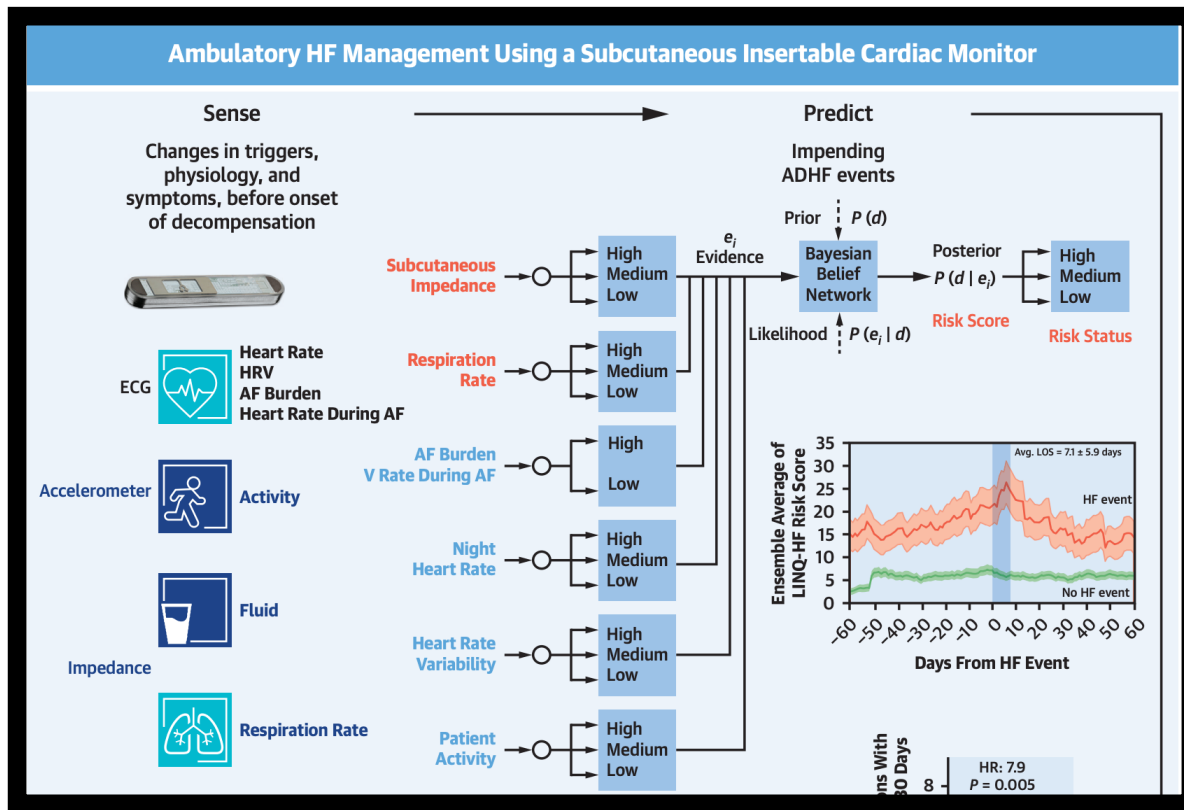
ICMs in Heart Failure: future directions

A Novel Heart Failure Diagnostic Risk Score Using a Minimally Invasive Subcutaneous Insertable Cardiac Monitor

Michael R. Zile, MD,^a Rami Kahwash, MD,^b Shantanu Sarkar, PhD,^c Jodi Koehler, MS,^c Todd Zielinski, PhD,^c
Mandeep R. Mehra, MD, MSc,^d Gregg C. Fonarow, MD,^e Sanjeev Gulati, MD,^f Javed Butler, MD^g

Objectives The purpose of this study was to examine performance of ICM-based, multiparameter, dynamic HFRS to predict HFEs in patients with NYHA functional class II/III HF.

ICMs in Heart Failure: future directions



ICMs in Heart Failure: future directions

	Cohort	Sensitivity	False Alert rate
Development	First data set (n = 42, 19 HFE)	73.7%	1.4 /pt-yr
Validation	Second data set (n = 94, 19 HFE)	68.4%	1.5 /pt-yr

Using a high-risk threshold = 7.5%, development and validation data sets: sensitivity was 73.7% and 68.4%; unexplained detection rate of 1.4 and 1.5 per patient-year; median 47 and 64 days early warning before HFE.

ICMs in Heart Failure: next steps

Dynamic risk stratification of worsening heart failure using a deep learning-enabled implanted ambulatory single-lead electrocardiogram.

Implantable loop recorders (ILRs) provide continuous single-lead ambulatory electrocardiogram (aECG) monitoring. Whether these aECGs could be used to identify worsening heart failure (HF) is unknown.

ICMs in Heart Failure: next steps

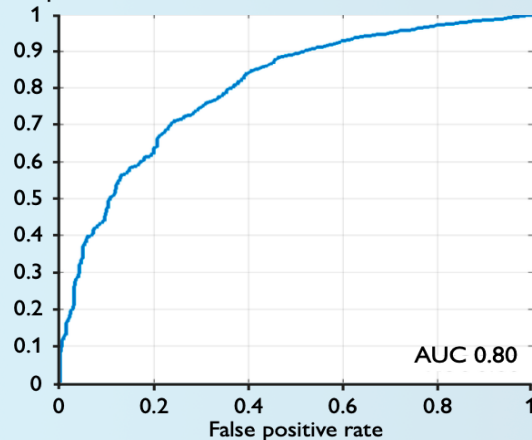
Dynamic risk stratification of worsening heart failure using a deep learning enabled implanted ambulatory single lead ECG



2,247 Patients

AI can identify left ventricular impairment using implantable loop recorder ECGs

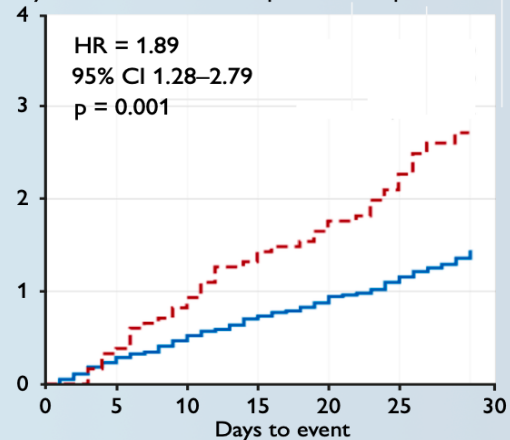
True positive rate



35,741 ECGs

This can identify patients at increased risk of heart failure hospitalization

Monthly evaluation with subsequent HF hospitalization



Cardiac Magnetic Resonance and ICM

ORIGINAL ARTICLE

WILEY

Cardiovascular magnetic resonance-GUIDEd management of mild to moderate left ventricular systolic dysfunction (CMR GUIDE): Study protocol for a randomized controlled trial

Joseph B. Selvanayagam MBBS (Hons), FRACP, DPhil, FESC, FCSANZ^{1,2,3,*} | Trent Hartshorne MBBS, FCICM, FRACP^{1,2,*} | Laurent Billot MSc, MRes⁴ | Suchi Grover MBChB, PhD^{1,2,3} | Graham S. Hillis BMedBiol, MBChB, PhD, FRCP (Edin), FACC, FCSANZ⁵ | Werner Jung MD, FESC, FHRS⁶ | Henry Krum MBBS PhD FRACP⁷ | Andrew D. McGavigan MBChB, MD, FRCP (C)

Participant Group/Arm ❶	Intervention/Treatment ❶
Other: Device Implantation A prospective, blocked, randomised, controlled trial of primary prophylaxis ICD therapy or ILR insertion in patients with LVEF <45% and LGE on CMR.	Device: ICD • Insertion of ICD in patients with LVEF <45% and LGE on CMR. Device: ILR • Insertion of ILR in patients with LVEF <45% and LGE on CMR.
No Intervention: Observational Registry A prospective observational registry of patients with LVEF <45% and no LGE on CMR.	

Arrhythmic risk in HF pts that recovers FE after therapy with new HF drugs?

Heart*Rhythm*

The Official Journal of the Heart Rhythm Society, The Cardiac Electrophysiology Society,
and The Pediatric & Congenital Electrophysiology Society



Heart
Rhythm
SocietySM

The present and the future of risk stratification for and prevention of sudden cardiac death: A Heart Rhythm Society think tank meeting

Sana M. Al-Khatib, MD, MHS,¹ Michael J. Ackerman, MD, PhD,² Robert M. Califf, MD,¹ Mina K. Chung, MD,³ Sumeet S. Chugh, MD,⁴ Anne B. Curtis, MD,⁵ Nikolaos Dargatzis, MD,⁶ Kenneth A. Ellenbogen, MD,⁷ G. Michael Felker, MD,¹ Ian Goldenberg, MD,⁸ Jeff S. Healey, MD,⁹ Valentina Kutiyafa, MD,⁸ Carolyn S.P. Lam, MBBS, PhD,¹⁰ Rod S. Passman, MD,¹¹ Jeanne E. Poole, MD,¹² Silvia G. Priori, MD, PhD,¹³ Andrea M. Russo, MD,¹⁴ Jagmeet P. Singh, MD, PhD,¹⁵ Natalia A. Tryanova, PhD,¹⁶ Paul J. Wang, MD,¹⁷ Brianna H. Wolfe, BS,¹⁸ Christine M. Albert, MD, MPH¹⁹

- Could ICM monitoring be useful to safely following those patient after FE recovery ?

Conclusions

- ICM can be useful in monitoring patients at risk of HF worsening and in profiling HF patients for the presence of arrhythmias
- Thanks to the technological advancements, more precise AF diagnosis, PVCs identification and sensor-enabled activity monitoring are now available to help physicians
- Prevention of HF-worsening is possible, by identification of AF occurrences, of increasing PVCs burden or of emerging chronotropic incompetence
- Arrhythmic risk score integrated with cardiac MR
- Future developments as the use of AI and/or of other sensors are promising