

Left Ventricular Fibrosis Predicts Left Atrial Remodeling in Atrial Fibrillation and Systolic Heart Failure

Louise Segan^{a,b,c,d}, David Chieng^{a,b,c,d}, Hariharan Sugumar^{a,b,c,d}, Aleksandr Voskoboinik^{a,b,c,d}, Liang-Han Ling^{a,b,c,d}, James Hare^a, Andrew Taylor^{a,b}, Shane Nanayakkara^{a,b}, Ahmed Al-Kaisey^e, Joshua Hawson^e, Manuja Premaratne^f, Geoffrey Lee^{c,e}, Alex J McLellan^{c,e}, Stephen Joseph MBBS, PhD^g, Ramanathan Parameswaran^h, Benedict Costello^{b,g}, Jonathan M Kalman^{c,e}, Peter M Kistler^{a,b,c,d,e}, Sandeep Prabhu MBBS, PhD^{a,b,c}

^aThe Alfred Hospital, Melbourne, Australia | ^bBaker Heart and Diabetes Institute | ^cUniversity of Melbourne | ^dCabrini Hospital | ^eRoyal Melbourne Hospital | ^fPeninsula Health | ^gWestern Health | ^hUniversity Hospital Geelong

Background

AF and systolic heart failure (HF) are accompanied by left atrial (LA) structural and electrical remodeling. However, the relationship between left ventricular (LV) myocardial fibrosis and LA remodeling is uncertain.

Aim

Evaluate the relationship between left ventricular myocardial fibrosis and left atrial electrical remodeling in patients with AF and systolic heart failure undergoing catheter ablation.

Method

Patients with AF and systolic HF (LVEF $\leq 45\%$) undergoing catheter ablation (CA) (between 2018 to 2023) were stratified according to the presence or absence of CMR-detected ventricular late gadolinium enhancement (LGE) and underwent detailed left atrial (LA) electroanatomical mapping at the time of AF ablation.

Results

Sixty-four patients met inclusion criteria and underwent CMR (16.1% female, age 59.6 ± 12 years, mean LVEF $32 \pm 8\%$). LGE positive individuals (N=31) had more prevalent vascular (38.7% vs 3.2%, $p < 0.001$) and coronary disease (45.2% vs 3.2%, $p < 0.001$), higher CHADS2VASc score (median 3 (IQR 2-3.5) vs 2 (1-3), $p = 0.031$) and longer AF duration (median duration 7 (5.8-12) vs 6 (4-7) months, $p = 0.022$).

Baseline echocardiographic parameters, including LVEF, were comparable between groups (all $p > 0.05$).

Ventricular LGE was accompanied by more advanced LA electrical remodeling, with greater global and regional scar (bipolar voltage < 0.05 mV) and low voltage (< 0.5 mV) burden (all $p < 0.05$) compared to LGE negative individuals.

The presence of LGE was significantly associated with global ($R = 0.593$, $p < 0.001$) and posterior low voltage ($R = 0.414$, $p = 0.043$) with a positive correlation between LGE burden and percentage of LA posterior wall low voltage area (LVA, figure 1).

Figure 1: correlation between posterior wall LVA and LV LGE burden

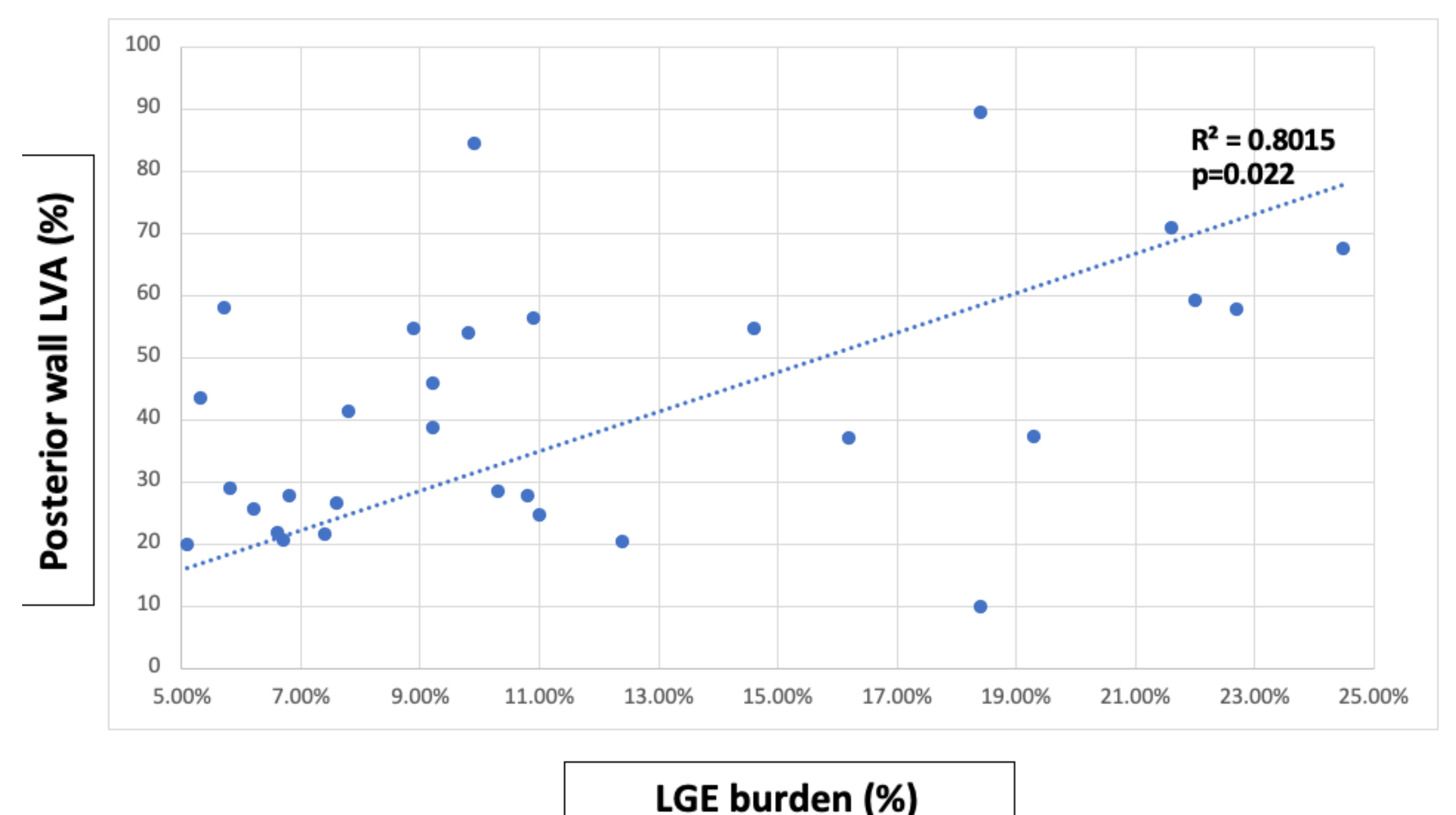
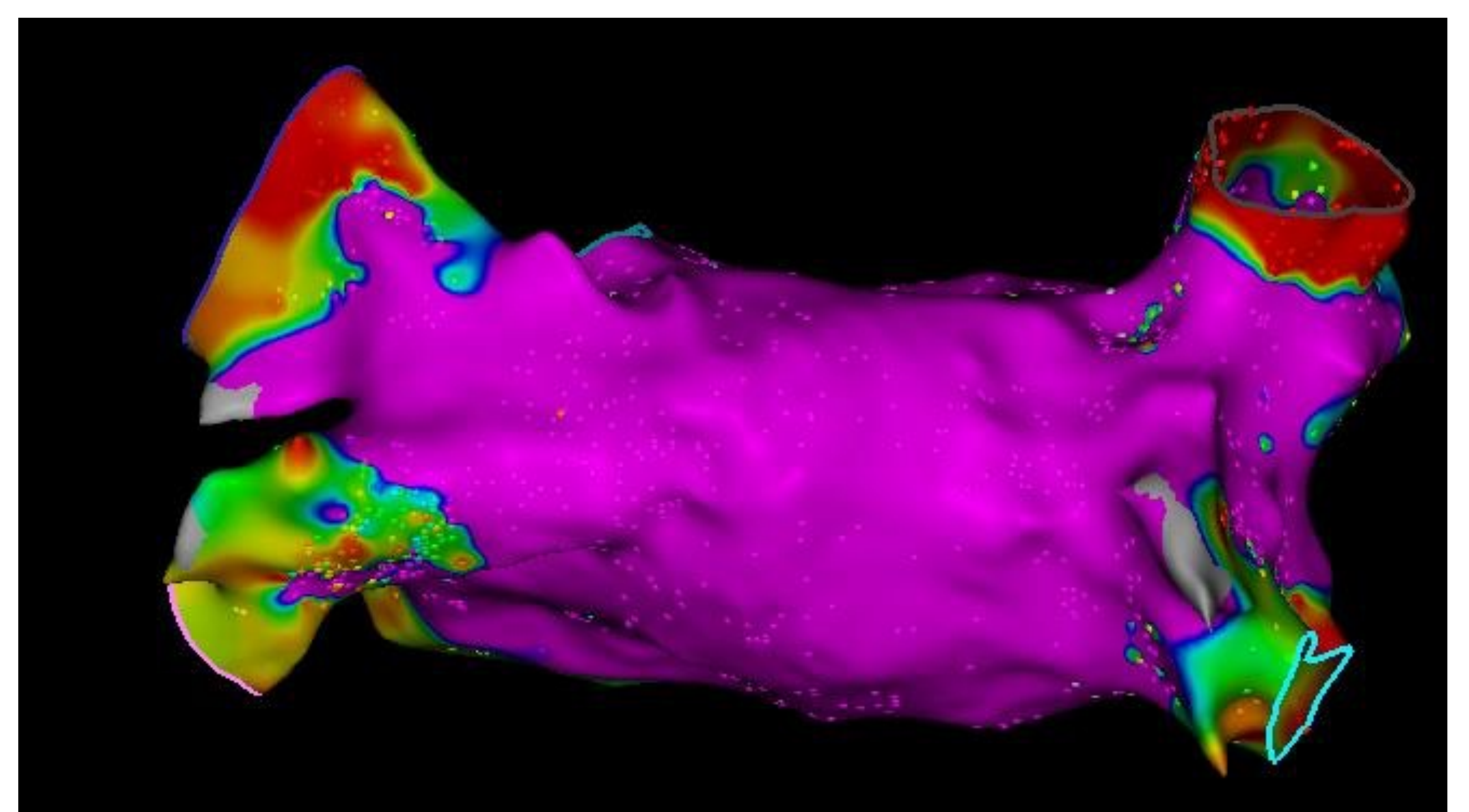


Figure 1: positive correlation between ventricular LGE burden and posterior wall low voltage.

Figure 2: Example of LA bipolar voltage map



Conclusion

In AF and systolic heart failure, ventricular scar correlated with more advanced LA electrical remodeling, despite comparable LVEF and structural remodeling at baseline. In AF and HF, pathologic remodeling resulting in ventricular scar likely also occurs in the atria, contributing to AF substrate.