# Artificial intelligence-predicted poor responders to catheter ablation for atrial fibrillation

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**Introduction:** Although atrial fibrillation (AF) catheter ablation is effective for rhythm control, in some patients it is hard to maintain sinus rhythm in spite of repeated AF catheter ablation (AFCA) procedures and anti-arrhythmic drugs (AADs). We explored the pre-procedural predictors for poor responders to AFCA and tested whether artificial intelligence (AI) assists the prediction of poor responders in the independent cohort by determining the invasive parameters.

**Methods:** Among 1,214 patients who underwent AFCA and regular rhythm follow-up for 56.2 ± 33.8 months (59 ± 11 years, 73.5% male, 68.6% paroxysmal AF), we differentiated 92 poor responders defined as those with sustained AF despite repeat AFCAs, AADs, or electrical cardioversion. Using the Youden index, we identified advanced LA remodeling with lower LA voltage under 1.109mV. AI model, which was derived from development cohort using medical record, was applied to predict LA voltage <1.109mV in the independent cohort (n = 634, poor responders = 24) using a grad-cam score.

**Results:** The patients with lower LA voltage under 1.109mV showed significantly poorer rhythm outcomes (Log-rank p < 0.001). We determined invasive parameter LA voltage by using the multiple variables (age, female sex, AF type, CHA2DS2VASc score, LA dimension, E/em, hemoglobin, PR interval) and achieved relatively good prediction power of AI for LA voltage <1.109mV (AUC = 0.734, sensitivity 0.729, specificity 0.643) in the test cohort. In the independent cohort, the AI model showed good discrimination power for poor responders (AUC 0.751, p < 0.001) by estimating LA voltage, which is an invasive variable. The patients with predicted lower LA voltage (grad-cam score <0) showed poorer rhythm outcome after active rhythm control (Log-rank p < 0.001)

**Conclusions:** The patients with advanced atrial remodeling with low LA voltage, which can be predicted by an AI, showed significantly higher recurrence of AF after AFCA with AADs or cardioversion. AI may assist to select these poor responder patients before the AFCA procedure.

Abstract Figure.

**Figure. KM curve for poor responders according to Grad-Cam score in independent cohort**