

## ECG Spatiotemporal Complexity Predicts Catheter Ablation Outcome of Persistent Afib

M. Meo<sup>1</sup>, D.G. Latcu<sup>2</sup>, V. Zarzoso<sup>1</sup>, O. Meste<sup>1</sup>, M. Garibaldi<sup>1</sup>, I. Popescu<sup>2</sup>, N. Saoudi<sup>2</sup>

<sup>1</sup>Laboratoire I3S, Université Nice Sophia Antipolis, CNRS, Sophia Antipolis, France

<sup>2</sup>Centre Hospitalier Princesse Grace, Monaco

### Introduction.

Patient selection is a critical issue for improving results of radiofrequency catheter ablation (CA) of persistent atrial fibrillation (AF). Classical standard 12-lead ECG atrial activity (AA) parameters (e.g., mean amplitude, cycle length) were studied in a single lead, so neglecting AA spatial variety and temporal evolution. We examined the potential role of AA spatiotemporal variability in CA result prediction.

### Methods.

One-minute ECGs were acquired at the start of CA. Unlike single-lead methods, normalized mean square errors (NMSE) between successive AA segments in the 8 independent leads of the standard ECG are combined to quantify AA spatiotemporal diversity. They are approximated by the first source computed by the principal component analysis (PCA), as it accounts for the maximum data variability, thus extracting the most descriptive AA components common to leads retained. Mean NMSE values/lead are then weighted by their inverse variance into a pondered sum  $\tilde{\mu}_1$ , so emphasizing leads with more stationary AF. Freedom from ECG/Holter documented sustained AF recurrence (> 30 s) during follow-up denotes CA success.

### Results.

We enrolled 20 patients (pts; 19 males, 60±11 y) with a median AF episode duration of 4.5 months (m; 2-84). After 1.15 procedures/pt and a median follow-up of 9.5 m (4-19), CA was effective in 13 pts (65%). Higher  $\tilde{\mu}_1$  values suggest more organized and repetitive AA patterns, significantly correlated with CA success, Table I. Prediction power is assessed by the area under the ROC curve (AUC) index.  $\tilde{\mu}_1$  is compared with the mean NMSE  $(\text{NMSE}_{V_1})_1$  and AA amplitude  $D(V_1)$  in  $V_1$ .

### Conclusion.

Our multilead CA outcome predictor proves to be more accurate than standard single lead approaches.

Table I: CA result predictors

	Successful CA	Unsuccessful CA	<i>p</i> value	AUC	Best Cutoff
$\tilde{\mu}_1$ [%]	65.68 ± 19.27	37.59 ± 21.88	0.008	0.84	45.57
$(\text{NMSE}_{V_1})_1$ [%]	58.09 ± 23.49	80.40 ± 22.88	0.056	0.71	76.34
$D(V_1)$ [mV]	0.08 ± 0.03	0.06 ± 0.01	0.030	0.80	0.05