

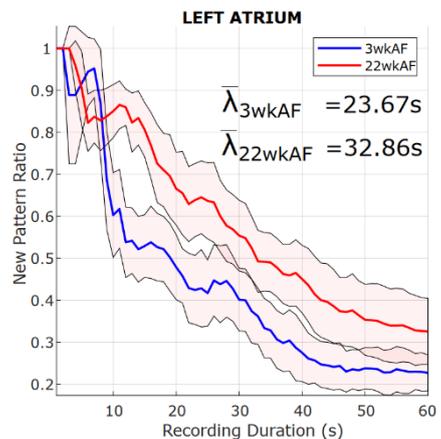
# Incidence of Distinct Repetitive Atrial Activation Patterns as a Metric for Atrial Fibrillation Complexity

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**Aims:** During atrial fibrillation (AF) highly complex atrial conduction patterns can be frequently interrupted by more repetitive atrial activation patterns (RAAPs) that are present for multiple consecutive cycles. RAAPs might be linked to AF maintenance mechanisms. We hypothesized that patients with less complex AF driven by a small number of sources exhibit a limited number of distinct RAAPs over time. This in turn may provide information about AF substrate complexity. Therefore, we investigated the decrease of the proportion of distinct RAAP detections over time in a goat model of sustained AF.

**Methods:** High-density atrial electrograms were recorded for 60-seconds on left/right atria (LA/RA) of a goat model with different durations of sustained AF [3 weeks (3wkAF, n=8) and 22 weeks (22wkAF, n=8)] using a 249-electrode mapping array (2.4mm spacing). In each recording, RAAPs were detected as patterns repeating at least for two consecutive cycles using recurrence plots. Detected RAAPs were classified as new or recurring based on their similarity to previous RAAPs. The ratio of new



patterns (to all patterns) was computed in steps of 1 seconds for all recordings. Resulting curves were modeled as exponential decay functions. Half decay rate ( $\lambda$ ) was used to characterize each recording. **Results:** 24 out of 32 curves could be successfully modeled as exponential decay functions with adjusted R-squared > 0.75 while others presented more irregular decaying patterns (3wkAF LA:2 RA:3, 22wkAF LA:1 RA:2). Half decay rates were significantly shorter in LAs of 3wkAF goats ( $\lambda_{3wkAF} = 23.67s$  vs.  $\lambda_{22wkAF} = 32.86s$ ,  $p < 0.05$ , Mann-Whitney U-test). There was no significant difference in RA. **Conclusion:** In 75% of AF maps in a goat model of AF, the incidence of distinct RAAPs decayed quickly within 60s, suggesting the presence of spatiotemporal stability of AF patterns. (Non)invasive characterization of this stability in patients might pave the way for better stratification for AF treatment.