

High bi-atrial organization in patients with long-standing persistent atrial fibrillation terminated within the left atrium

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Introduction

- Persistent atrial fibrillation (AF) is maintained by sites displaying high dominant frequency (DF) values.
- Conflicting results were reported regarding the spatial distribution of DF and the existence of a left-to-right atrial DF gradient in patients (pts) with long standing persistent AF (LS-pAF).
- We hypothesized that the pre-ablation bi-atrial DF of LS-pAF pts terminated within the left atrium (LT group) displays smaller value, hence a higher organization, than that of non terminated ones (NT group).

Methods

Patients Characteristics and Data Acquisition

- 26 consecutive pts with a mean LS-pAF duration of 22±13 months (table 1) underwent a stepwise catheter ablation procedure (step-CA) as depicted in figure 1.
- Prior to step-CA, the following catheters (CATH) were introduced via right and left femoral veins :
 1. Quadripolar CATH into the right atrial (RA) appendage (RAA).
 2. Decapolar CATH into the coronary sinus (CS).
 3. Duodecapolar CATH into the left atrium (LA) for DF mapping.
- LA and RA were mapped sequentially as shown in figure 2 (red dotted lines).
- 20-sec epochs were acquired at each location. Each 20-sec epoch was subsampled into non overlapping 4-sec sub epochs.
- The inter-atrial DF gradient was defined as the DF difference between LA and RA appendages.

Signal Processing

- The following spectral analysis was performed¹:
 - Signal rectification.
 - Band-pass (1-20 Hz) Butterworth filter.
 - Frequency spectra calculated by Fast Fourier Transform.
 - DF was defined as the as the largest peak within the power spectrum between 3-15 Hz.
- The DF was computed for all subepochs, averaged, and compared across the two groups (LT vs NT) over all bi-atrial segments within the analysis of variance framework.
- The inter-atrial DF gradient was considered significant if ≥ 1 Hz.

Clinical characteristics	Study population
Age (y)	61 ± 7
Male/Female	24/2
AF duration (y)	7 ± 5
Sustained AF (month)	22 ± 13
BMI (kg/m ²)	31 ± 6
LVEF (%)	47 ± 11
LA volume (ml)	173 ± 28

Table 1: clinical characteristics

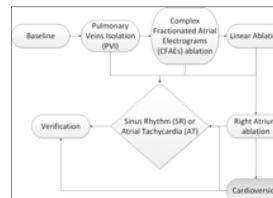


Figure 1: step-CA ablation protocol

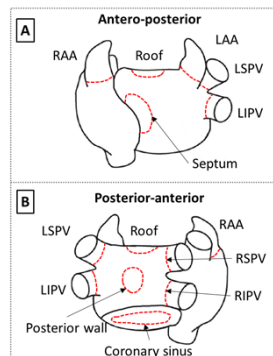


Figure 2: bi-atrial DF mapping.

Results

Clinical Results

- LS-pAF terminated in 81% of the pts during LA ablation (LT), and was non terminated (NT) in 19% of the remaining pts in spite of bi-atrial ablation.
- Table 2 shows the clinical characteristics for the LT and NT groups.

Clinical characteristics	Left terminated LT = 21 (81%)	Not terminated NT = 5 (19%)	p values
Age (y)	61 ± 8	63 ± 5	p = 0.5
Male/Female	19/2	5/0	p = 0.5
AF duration (y)	8 ± 6	4 ± 2	p = 0.1
Sustained AF (month)	17 ± 8	39 ± 11	p = 0.002
BMI (kg/m ²)	32 ± 6	27 ± 7	p = 0.3
LVEF (%)	44 ± 10	54 ± 13	p = 0.2
LA volume (ml)	179 ± 26	164 ± 33	p = 0.4
Cumulative ablation time (min)	46 ± 17	65 ± 15	p = 0.05

Table 2: clinical characteristics for groups LT and NT. Importantly, all pts displayed similar characteristics including LA volume, except for the duration of sustained AF which was significantly different between the two groups.

Bi-atrial Frequency distribution

- Figure 3 shows before ablation that bi-atrial DF values of LT pts were significantly lower than that of NT pts for each LA segments as well as for the RAA ($p < 0.05$).

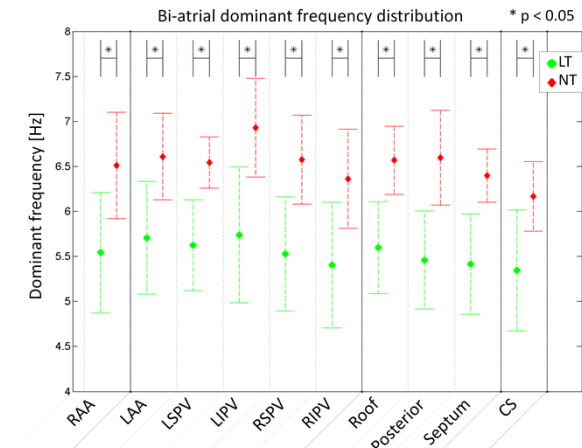


Figure 3: bi-atrial frequency DF distribution before ablation for LT and NT groups. DF bi-atrial values of LT pts are significantly lower than that of NT pts.

Inter-atrial gradient

- No significant LA-to-RA DF gradient was observed both for LT (0.4 ± 0.5 , $p = ns$) and NT (0.3 ± 0.5 , $p = ns$) pts and between both groups.

Conclusion

- The lower DF values of LT pts is suggestive of a higher organization within both atria before ablation compared to NT pts.
- Our findings suggest that low bi-atrial DF values, but not inter-atrial DF gradient, might be of interest for selecting LS-pAF candidates for sinus rhythm restoration by step-CA.