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. Quadriplolar 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 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.

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).

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.