Low-Level Electromagnetic Fields Attenuate the Inducibility of Atrial Fibrillation

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INTRODUCTION

- Atrial fibrillation (AF) remains the most common sustained dysrhythmia encountered in clinical practice
- Current therapies aimed at rhythm control have disappointing efficacy at long-term sinus rhythm maintenance. Further, anti-arrhythmic drug therapy and catheter ablation have a number of associated side effects and risks
- Autonomic nervous system (ANS) remodeling contributes to AF pathogenesis in multiple ways, and recent studies have suggested that autonomic modulation may be an effective therapy for AF, with a variety of modalities under investigation
- The purpose of this study was to examine the effect of low-level electromagnetic field (LL-EMF) stimulation as a method of autonomic stimulation and AF suppression

METHODS

- **Population:** Paroxysmal AF patients, age 18-85
- **Exclusion criteria:** Valvular AF, persistent AF, left ventricular systolic dysfunction, prior ablation
- **Study design:** Randomized, sham-controlled, double blinded.
  - *Active group:* Pulsed LL-EMF (0.032 μG at 0.89 Hz) via a Helmholtz coil placed around the head and neck (Figure 1)
  - *Sham group:* Patient was positioned in the study device, but no stimulation was applied
- Following initial EP study, AF was induced by burst atrial pacing from the right atrial appendage [pacing cycle length (CL) 250-200 ms or the shortest CL that captured 1:1]. DC cardioversion was performed if AF lasted longer than 15 minutes
- Following this, the stimulation protocol (active or sham) was turned on for 60 minutes. During this time, trans-septal access and mapping were performed, but no ablation occurred
- After 60 minutes, repeat AF induction occurred, again noting duration of induced-AF
- **Primary endpoint:** Change in duration of pacing-induced AF

RESULTS

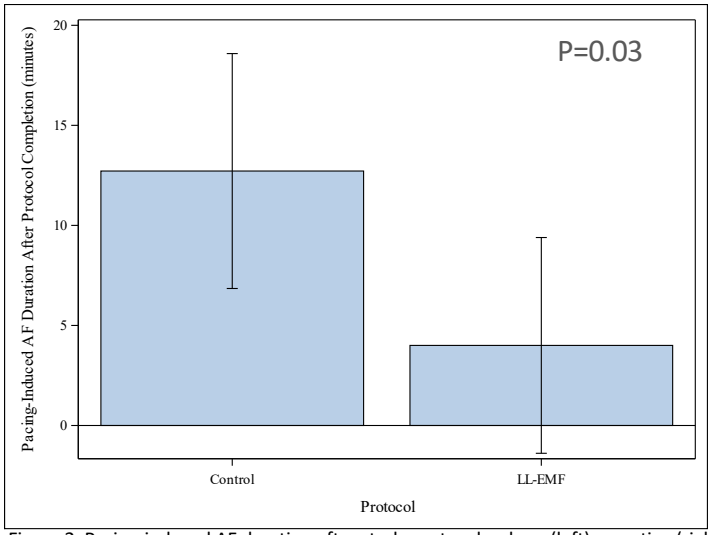

Figure 2. Pacing-induced AF duration after study protocol – sham (left) vs. active (right)

Figure 1. Study device

	Control (n=6)	EMF (n=7)	p-value
Age (years)	60 (58-63)	60 (56-65)	0.71
BMI	29.6 (27-35)	28.0 (20.3 – 36)	0.90
Male	3 (0.5)	3 (0.43)	>0.9
Time from diagnosis (months)	30 (24-72)	24 (12-48)	0.62
Hypertension	3 (0.5)	4 (0.57)	>0.9
Diabetes	1 (0.17)	3 (0.43)	0.56
Coronary Disease	0 (0)	1 (0.14)	>0.9
Obstructive Sleep Apnea	3 (0.5)	3 (0.43)	>0.9
Ejection Fraction (%)	55 (55-60)	55 (55-59)	0.93
CHA_2DS_2VASc Score	1 (0-2)	2 (1-2)	0.22
Beta-Blocker	3 (0.5)	4 (0.57)	>0.9
ACEi/ARB	0 (0)	2 (0.29)	0.46
Amiodarone	0 (0)	2 (0.29)	0.46
Other AAD	2 (0.33)	5 (0.71)	0.29
Left Atrial Size (cm)	4.37 (4.28-4.5)	3.9 (3.35-5.6)	0.91
Left Ventricular Septal Thickness (cm)	1.1 (1.1-1.3)	1.1 (1.05-1.3)	0.96
Cryoballoon ablation	3 (0.5)	4 (0.57)	>0.9

Table 1. Baseline characteristics

*Data presented as median (interquartile range) or count (proportion) as appropriate

CLINICAL IMPLICATIONS

- LL-EMF is under investigation as a therapeutic modality in a variety of conditions, and may have a role as method of non-invasive autonomic modulation
- This study provides proof-of-concept for LL-EMF as a non-invasive therapy for AF via vagal stimulation
- The real-world applicability of these results will require further study
  - Commercially-available LL-EMF stimulator currently approved for relaxation therapy – use as AF treatment in the ambulatory setting?

CONCLUSIONS

- LL-EMF application resulted in a reduction in pacing-induced AF duration after 60 minutes of stimulation as compared to sham stimulation
- Notably, fewer patients in the LL-EMF group required cardioversion after the 60-minute period (1/7 vs. 5/6, p = 0.03). Thus, the effect size may have been larger had each episode of AF been allowed to continue until spontaneous termination
- Importantly, there were no adverse events related to the study device

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