Non-Pulmonary Vein Triggers of Atrial Fibrillation in Patients with Complete Pulmonary Vein Isolation

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Background

- Patients with recurrences of AF after PVI present a clinical dilemma when veins remain isolated.
- High-Frequency Stimulation (HFS) can be used to stimulate presumed ganglionated plexus sites (GP) that reproducibly trigger atrial ectopy and AF.

Location of ganglionated plexuses
1. Superior RA (adjacent to RUPV)
2. Superior LA (adjacent to LUPV)
3. Posterior RA (in between RUPV and RIPV)
4. Posteromedial LA (adjacent to RIPV)
5. Posterolateral LA (adjacent to LIPV)
How do we locate these GPs?

Can we identify GP sites in patients with completely isolated pulmonary veins? (non-PV triggers)
Methods

- **Inclusion criteria:** 18-85yrs old, good LVSF, <5cm LA diameter, no stroke in the past 6 months, no significant CAD

- **Exclusion criteria:** On amiodarone

- Stopped all AADs 48hrs prior to ablation.
GA induction + TOE

TSP -> 3D CARTO mapping of left atrium

Complete PVI

HFS mapping of the whole of left atrium in all patients

Tag both +ve and –ve responses to HFS on CARTO geometry

Ablate ET-GPs if randomised to GP + PVI arm

Pace for at least 4 beats to ensure no V capture. HFS at 40Hz, 14V, 20ms delay from pacing spike to ensure HFS is delivered within the atrial refractory period.

A positive response to HFS was called ectopy-triggering GP site (ET-GP).
Example set-up

PV catheter inserted into nearest vein to HFS site

MAP catheter used to pace and stimulate with HFS

Key
Green = ET-GP
Purple = HFS –ve

Coronary Flow Trust
Two patients with complete PVI at the start of procedure
Patient 1

- 50yrs, M
- HTN
- OSA, CPAP daily

- 1st PVI 2014
- 2x further redo PVI since

- 2017 – recruited to study.
- All PVs remained isolated, one tightly stenosed.
Patient 1

Key

Green = ET-GP
Purple = HFS –ve
Blue = AV blocking but no ectopy/AF

- 107 HFS sites
- 11 ET-GPs identified (non PV-triggers)
Atrial fibrillation

4s asystole

V signal from A pacing

Isolated PV
Lasso poles 9-10, 11-12, 13-14 hanging out into left atrium

Map catheter position
Patient 2

- 70yrs M
- PsAF previously, PVI + mitral line + roof line 2011
- Recurrence with PAF

- 2017 – recruited to study.
- Completely isolated veins. Mitral line and roof line remain blocked.
Patient 2

- 87 HFS sites
- 5 ET-GPs (non-PV triggers) – all caused sustained AF
- 14 AV-blocking GPs

**Key**

Light Green = ET-GP  
Dark green = AV blocking GPs  
Purple + Pink = HFS –ve
Patient 2

- V signal from A pacing
- HFS trains
- Ectopy
- AT induced
- Isolated PV
- No signal
- Map catheter position
Results

- 17 patients were studied.
- 2 patients had complete PVI at start of procedure.
- 15 patients had re-connected PV(s) and underwent HFS mapping after PVI.
- 3 patients had no ET-GPs identifiable post PVI.
  - 1 of these patients could not have ET-GPs mapped due to persistent AF
- On average, 80 ± 32 HFS points were tested per patient.
- This identified 1 to 13 ET-GPs per patient.
Interesting site that had PV ectopy with exit block with HFS
Catheter positioning

PV catheter in LSPV
Map catheter in L carina
CS catheter
Rapid PV activity with exit block

Isolated PV
Conclusion

• For the first time, we have demonstrated that non-PV triggers of AF can be identified in patients with complete PVI using HFS to stimulate ET-GPs.

• A significant proportion of ET-GPs in our patients remained capable of inducing ectopy/atrial arrhythmias even after complete re-isolation of PVs.

• ET-GP ablation in addition to PVI may be an alternative treatment for patients with PAF and AF recurrence.
Thank you.