BAROREFLEX CONTROL OF IMPULSE CONDUCTION IN THE RIGHT ATRIUM

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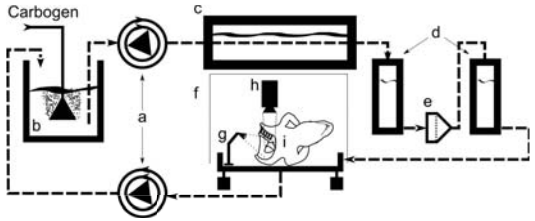
BACKGROUND

- Studies show the autonomic nervous system can be involved in the induction and maintenance of atrial fibrillation (AF).
- Episodes of paroxysmal AF are often preceded by progressive bradycardia due to activation of the vagus nerve: bradycardia could be part of the AF "substrate".
- What are the effects of vagal bradycardia on regional impulse conduction in the right atrium?
- How does nerve density relate to control of regional conduction?
- Mapping of optical action potentials used in conjunction with baroreflex model of bradycardia for the first time.

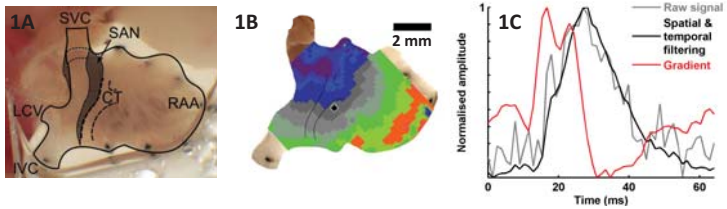
IN SITU PREPARATION OF THE RAT WITH REFLEX AUTONOMIC FUNCTION

- Rat heart and brain stem artificially perfused by pump via aorta.



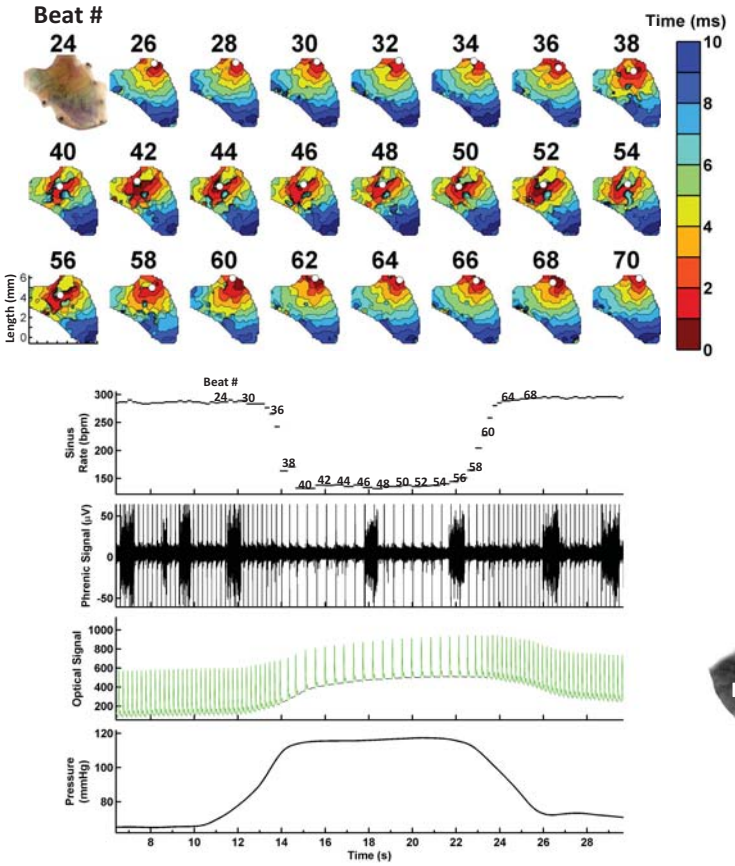
Legend:

a. Peristaltic pump
b. Perfusate reservoir
c. Heat exchanger
d. Bubble-traps
e. 25 µm filter
f. Recording chamber
g. LED excitation λ 525 nm
h. CCD detector
i. In situ preparation



- Optical action potentials recorded from right atrium stained with voltage-sensitive fluorescent dye (di-4-ANEPPS).
- Activation time defined at max positive gradient.

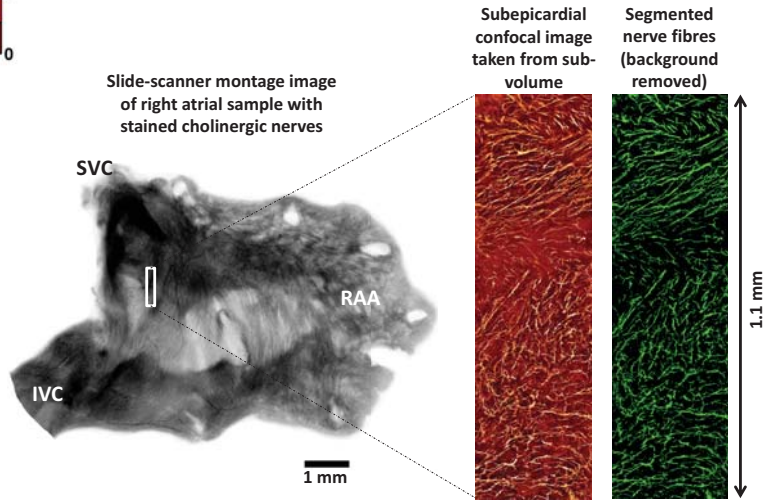
BAROREFLEX ALTERS DOMINANT PACEMAKER FIRING RATE AND LOCATION



- Baroreflex activated by acutely increasing perfusion flow rate resulting in a pressure challenge of ~45 mmHg over ~16 s.
- Reflex reduction in phrenic burst rate and sinus node firing rate.
- Shift in dominant pacemaker (site of earliest activation) to SA node tail.
- Conduction is fast parallel to CT muscle band but slow or blocked orthogonal to this structure.

NERVE DENSITY IS LOWER IN SA NODE TAIL

- Antibody labelling of cholinergic nerves and SA node pacemaker cells.
- Mount whole right atrial samples and image using slide-scanner.
- Further interrogate small volumes with confocal imaging.
- Segmentation using connected region-growing in 3D.
- Quantify density of nerves in different regions of the SA node.
- Preliminary result: nerve density is lower in subsidiary pacemaker regions in the SA node tail.



SUMMARY

- Methods have been developed to map atrial activation during baroreflex induced vagus nerve stimulation:
  - Baroreflex activation alters dominant pacemaker firing rate and location and causes slow or blocked conduction around the SA node tail.
- Variation in cholinergic nerve density may contribute to control of dominant pacemaker location.