

Fat tissue remodelling in persistent atrial fibrillation

3D quantitative analysis using high-resolution MRI

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Introduction

Atrial fibrillation (AF) burden [1]:

- Highly prevalent (1–5%)
- Doubling of mortality
- Substantial morbidity.

Structural changes (remodelling) [2]:

- Major contributor for accommodation and progress of AF
- (from paroxysmal to persistent to permanent).

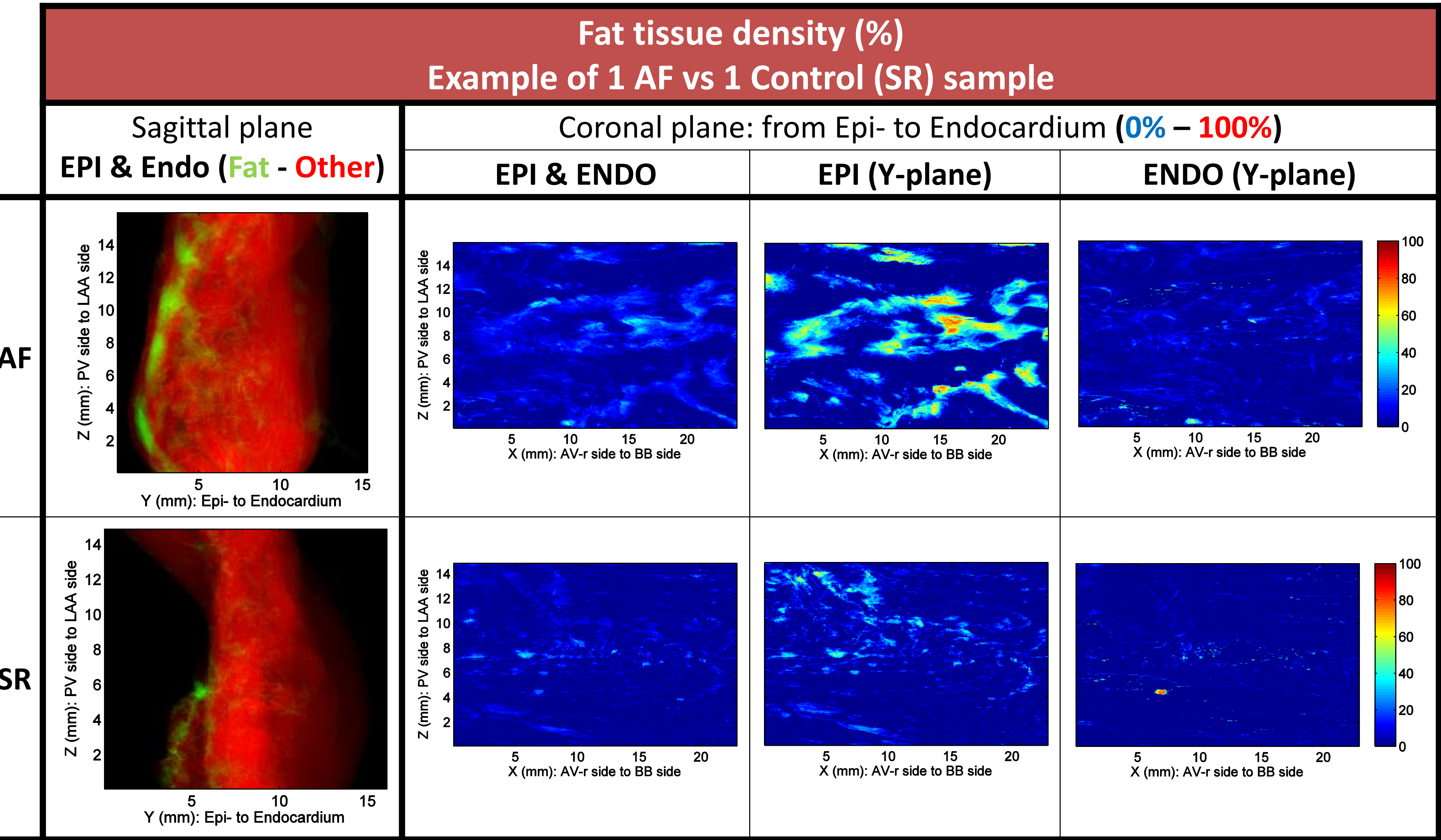
Fat tissue remodelling [3]:

- Potentially important, but poorly understood.
- Studies available: only on epicardium at relatively low resolution.

In this study we analyse:

- fat tissue remodelling in persistent AF,
- in the 3D structure of the goat left atrial wall (epi- to endocardium),
- at high resolution.

Results



| Fat tissue density Group Results (AF, SR) and Hypotheses Tests (AF > SR, EPI > ENDO) | | | | | |
|--|------------------|----------------|--------------|-----------|----------------|
| | EPI&ENDO (% fat) | EPI (% fat) | ENDO (% fat) | EPI/ENDO | p(EPI>ENDO) |
| AF (n=4) | 5.8 ± 1.4 | 12.0 ± 3.0 | 2.1 ± 0.7 | 5.8 ± 0.4 | 0.005 (< 0.01) |
| SR (n=4) | 2.7 ± 1.1 | 3.6 ± 1.3 | 1.7 ± 0.7 | 2.1 ± 0.5 | 0.047 (< 0.05) |
| AF / SR | 2.1 ± 0.3 | 3.3 ± 0.4 | 1.2 ± 0.5 | | |
| p(AF>SR) | 0.014 (< 0.05) | 0.007 (< 0.01) | 0.502 (NSS) | | |

Methods

| 1) Tissue sample | 2) MRI scan | 3) MRI selection | 4) MRI background | 5) MRI segmentation | |
|--|--|---|--|--|---|
| | | | | | |
| <ul style="list-style-type: none">Goat left atrial wall.Within clip-on frames.Viewing endocardium side.5 persistent AF + 6 control. | <ul style="list-style-type: none">Aligned: epi- to endocardium.Box selecting interest region.Axial (X-Y) plane.78µm (isotropic) resolution. | <ul style="list-style-type: none">Is same plane as in (2).Is selection box in (2).Colour scale to highlight heterogeneous background. | <ul style="list-style-type: none">MRI background correction using interpolation over rough tissue segmentation.Is same plane as in (2,3). | <ul style="list-style-type: none">Full tissue segmentation (red mask) over grayscale MRI.Fat tissue (= darkest MRI regions) segmentation afterwards.Is same plane as in (2,3,4). | <ul style="list-style-type: none">Volume rendering of tissue segmentation (5).Viewing endocardium side.Note resemblance with (1).Segmentations by threshold and morphology operations. |

Conclusions

There is fat **tissue remodelling in persistent AF, but only in the epicardium**, not in the endocardium.

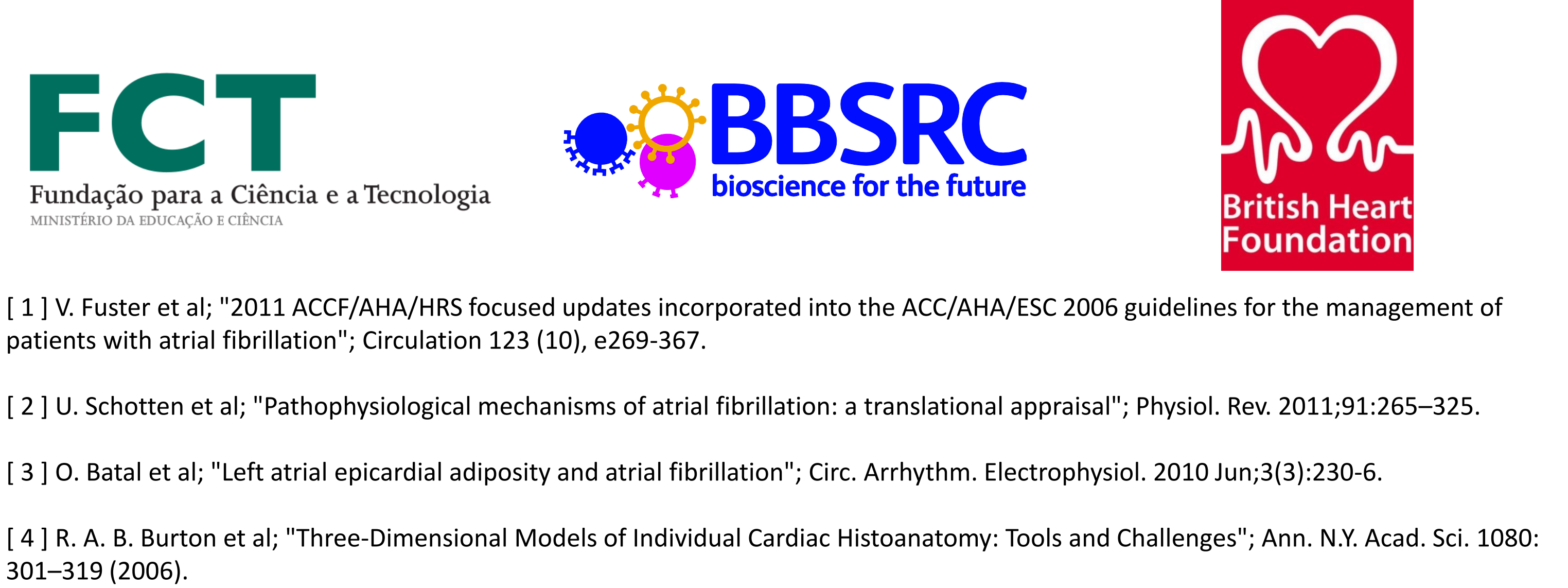
- AF group has higher percentage of fat in the full samples (EPI&ENDO) and in the EPI, but not in the ENDO.
- Control group already has an higher percentage of fat in EPI than ENDO, approx. 2.1x more, but in AF this factor increases to 5.8.

Fat agglomerates in relatively large connected structures (in the epicardium), which could have an **important impact in the electro-physiology of AF**.

Next, we will **compare these fat remodelling results with electro-physiology** to search for **structure-function relations**.

Acknowledgements & References

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