IMAGE FOCUS

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Optical coherence tomography allows 3D reconstruction of ablation lesions

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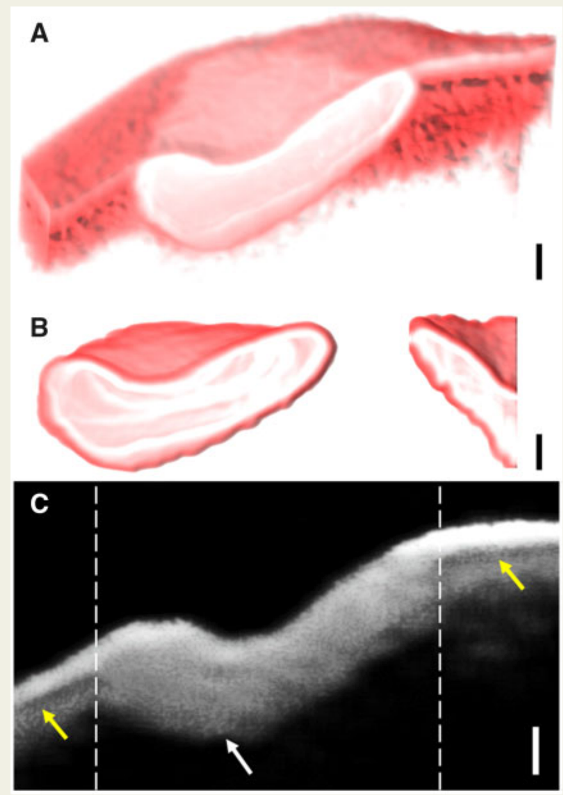

Radiofrequency catheter ablation (RFA) is an effective interventional treatment for atrial fibrillation. However, the immediate effect of RFA on the tissue is not directly visualized. This is a key limitation as only acute electrical measurements are taken into account and the atrial wall structure or ablation lesion form are neglected.

Optical coherence tomography (OCT) is an imaging technique that uses light to capture histology-like images with a moderate penetration depth of 1–3 mm in the cardiac tissue. It is well-established to characterize plaques in patients with coronary artery disease. Therefore, it might also be used for high-precision imaging of the small RFA ablation lesions. In a proof-of-concept study, we performed radiofrequency ablation lesions on freshly excised porcine cardiac tissue on the endocardial surface. Ten minutes after the ablation, the tissue was fixated in 10% neutral buffered formalin in order to preserve it (OCT images were acquired the following day). Afterwards, the tissue underwent OCT imaging with a dedicated system for technical details see also Liang D *et al*.: Radiofrequency ablation lesion assessment using optical coherence tomography - a proof-of-concept study. JCE 2019. After raw image acquisition, the images underwent further processing (e.g. filtering noise), to obtain the pre-processed OCT images (an example is shown in the figure, *Panel C*). By delineation of the lesion in adjacent OCT images, novel 3D reconstructions of ablation lesions were obtained. An example is shown in the figure, *Panels A* and *B*. In addition, we provide a 360° view reconstruction of this lesion in the online supplement (see Supplementary data online, *Video*). This demonstrates, that OCT has the potential to reveal a detailed direct visual assessment of ablation lesions. Ongoing research aims at the development of an ablation catheter equipped with an OCT imaging sensor at the tip. Thus, real-time lesion monitoring during ablation could become possible. By integration of this information into a 3D map acquired during an ablation procedure, this could further improve our understanding of performed lesions.

Panel A: An overview 3D reconstruction of an ablation lesion with surrounding tissue. *Panel B*: A 3D reconstruction of the isolated ablation lesion from *Panel A* (left) and a cross-sectional cut by 90° through the same lesion (right). *Panel C*: The underlying pre-processed OCT image of a single slice through the lesion. The white arrow indicates the lesion bottom, where the image intensity suddenly decreases. The yellow arrows indicate the birefringence artefacts (the black bands in the grey regions), which only appear in the untreated tissue. The dotted white lines indicate the boundaries of the lesion. A scale bar representing 1 mm is shown in *Panels A–C*.

Supplementary data are available at *European Heart Journal - Cardiovascular Imaging* online.