Data Fusion for Guidance and Modelling of EP Procedures

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Cardiac electrophysiology (EP) procedures are minimally invasive catheter-based procedures that are carried out for the diagnosis and treatment of electrical conduction pathologies of the heart. These procedures are conventionally guided using two-dimensional x-ray fluoroscopy and can be challenging due to the requirements of accurately positioning catheters within the heart and great vessels, structures that are not visualised by the penetrating x-ray radiation without the use of contrast agents.

This presentation will detail methods that have been developed to guide EP procedures using live x-ray fusion to three-dimensional (3D) cardiac anatomical models derived from imaging modalities such as magnetic resonance (MR) imaging (fig 1a), computerized tomography, ultrasound (US) (fig 1b) and 3D rotational angiography. The methods include the use of hybrid imaging systems (x-ray + MR [1-2] (fig 2a), x-ray + US [3]) and also conventional catheter laboratories. Methods will also be described for the correction of patient motion, such as bulk, cardiac, and respiratory [4] motions.

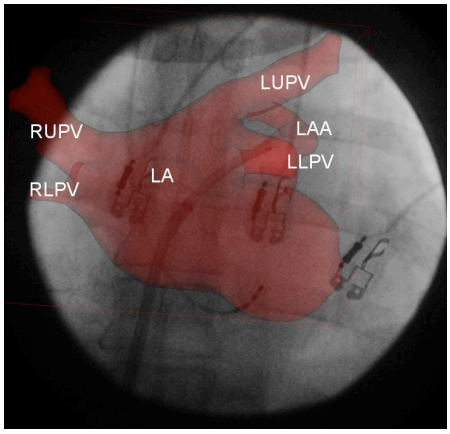

Fig 1a: Overlay of MRI-derived left atrial anatomy on to live x-ray fluoroscopy

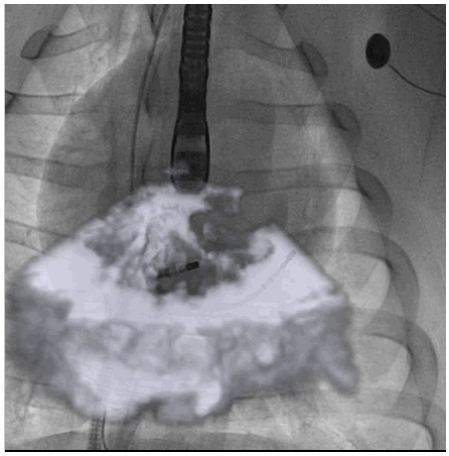

Fig 1b: Overlay of live 3D US on to live x-ray fluoroscopy (in swine)

The integration of motion-corrected anatomical information with live x-ray allows the derivation of the 3D spatial location of catheters within the patient anatomy and

therefore the measurements made by these devices, such as electrical signals, pressure, and flow. This can be achieved reconstruction from biplane x-ray imaging.

The second part of this presentation will show how the integration of anatomical information with catheter-based measured physiological data can be used for the validation and testing and cardiac electromechanical models of the heart [5]. The example of cardiac resynchronization therapy will be used for illustration (fig 2b).

Fig 2a: Hybrid x-ray / MR system

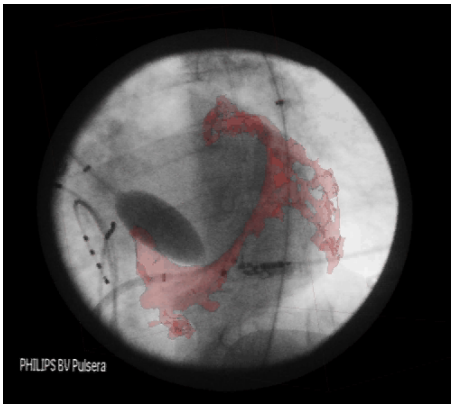

Fig 2b: Overlay of coronary venous anatomy on to live x-ray during a pacing study for cardiac resynchronisation therapy

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