Real-time interactive 3d simulation of Atrial Fibrillation for education

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Background: The mechanistic understanding of atrial fibrillation (AF) has burgeoned over the past decades. However, the interplay between triggers, reentry, drivers and therapies is rarely fully appreciated despite being ultimately fundamental to patient care. Readily accessible, high-fidelity interactive simulation has the potential to address this knowledge gap across healthcare providers.

Objective: To develop an interactive simulation system to allow deep understanding of AF mechanisms and therapies.

Methods: An application for e-Training was developed to be accessible on consumer smartphones and tablets, based on a validated electromechanical simulation model of the heart, with real-time interactive 3D image output. A virtual heart is represented in normal and arrhythmic states, enabled with simulated models for administering antiarrhythmic drugs, performing Pulmonary Vein Isolation (PVI), AV Node ablation, ventricular pacing, DC Cardioversion, plus the formation of atrial thrombus leading to a stroke event. Electrogram and ECG signals are generated from the underlying simulation and respond realistically to drugs, pacing and ablation. A self-study tutorial introduces the arrhythmia and treatment procedures. Learning outcomes are assessed with MCQ tests and receive Continuous Professional Development CPD credits.

Results: The AFib Sim app has received CPD accreditation in the UK and has so far been used at the Universities of Oxford, Cambridge and Leeds medical schools. All trainees and medical students followed the self-study tutorials and took the interactive MCQ test, which are embedded within the AFib Sim app. Development was based on Unity 3D and was made available on iOS, Android, macOS, MS Windows and WebGL platforms.

Conclusion: This project meets an urgent training need whilst expanding expertise and market scope into clinical training. The impact on clinical training was high and the societal benefit came from better and quicker trained staff.

Learning Objective: Upon completion of this session, the attendee will be able to understand how a simulation of Atrial Fibrillation can be used for training and deepening the clinical understanding of atrial fibrillation.