Remote magnetic navigation for catheter ablation of complex arrhythmias in congenital heart disease: an initial experience using a transnational telerobotic approach

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Background: The field of congenital electrophysiology (EP) is still in its relative infancy with a limited number of electrophysiologists capable of performing catheter ablation in patients with congenital heart disease (CHD). As a result, patients or physicians are often required to travel great distances to performed specialised ablation procedures, something made near impossible during the COVID-19 pandemic.

Objective: We aimed to explore the feasibility and safety of a telerobotic approach to catheter ablation where the remote operator was situated approximately 1200km away from the patient and local team.

Methods: A 3D-printed ‘phantom’ heart was used in a pilot experiment in which no significant difference was seen between the local and remote operators in electroanatomic (EAM) mapping of the phantom heart using remote magnetic navigation (RMN). Catheter ablation was subsequently performed in patients with severe CHD using a transnational telerobotic approach to catheter ablation where the remote operator was able to view the dedicated console with live fluoroscopy, EAM and EP signals, as well as control the mapping and ablation catheters from 1200km away. As a safety precaution, radiofrequency (RF) could only be delivered by the local team.

Results: In total, 10 procedures were performed in 9 patients with severe CHD (mean age 38) between April and December 2021. All patients underwent an atrial ablation and one additional non-CHD patient underwent denervation of the pulmonary arteries. Median procedure duration was 335 (minutes) (IQR 230-349) with 11.5 minutes (QRS 3-15.4) of fluoroscopy exposure and 752 (IQR 674-905) seconds of RF delivery. There were no acute procedural complications. At one-year follow-up, one patient died as a result of heart failure and there were two arrhythmia recurrences.

Conclusions: Telerobotic catheter ablation is feasible and effective and creates the possibility of exciting new approaches to remote ablation and its use in the tele-proctoring of international fellows.