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COMMENTARY

Integration of new mapping tools into remote navigation systems: every journey begins with a single step

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The technological advances in clinical cardiac electrophysiology over the last 20 years have been short of impressive. Nowadays, invasive arrhythmia experts can perform ablation procedures of complex cardiac arrhythmias with improvement in success rates and safety [1]. Beyond effectiveness and safety, the third paradigm of the ablation procedures is efficiency in a constantly busier electrophysiology laboratory. With better familiarity of techniques and technologies, our procedures are becoming shorter, and advancements to improve efficiency in the lab are welcome so we can perform procedures safely and effectively in shorter time which translates to ability of treatment of wider patient population. Of the technological advancements in invasive cardiac electrophysiology, the use of electroanatomical mapping system is perhaps one of the most salient [2]. The currently available electroanatomical mapping systems rely on tissue contact, acquisition and recording of electrical signals, and displaying them on the 3-dimensional space so the acquired map can be used to monitor and guide the ablation interventions in addition to provide mechanistical insights of the arrhythmogenic substrate [2]. But many times, short lasting or unstable rhythms cannot be mapped, and we must rely on alternative methods and limited surrogates to call acute success that might lead to longer procedures or unacceptable long term success rates. Therefore, new methods of electroanatomical mapping are needed that can not only improve efficiency but also can improve understanding of the underlying arrhythmogenic mechanism. Recently, a new non-contact charge density mapping system has been reported and used for mapping and ablation of atrial arrhythmias. In addition to non-contact mapping, this new system uses a multipolar basket mapping system capable of acquiring chamber anatomy by including 48 tiny ultrasound sensors and 48 electrodes to acquire high-density electroanatomical maps [3]. By moving and roving this multipolar basket catheter, the 48 ultrasound transducers reconstruct atrial anatomy based on the time of return of ultrasounds signals emitted by the catheter thus reconstructing the end-diastolic chamber anatomy. The 48 engineered biopotential electrodes, based on the inverse solution, can record unipolar intracardiac voltage potentials and calculate the cardiac activation as charge density maps. The limited data published so far have shown the utility of this system to acquire maps in a question of a few minutes and through novel software and algorithmic methods to map short-lived atrial arrhythmias [4]. The novel system has been studied for mapping and ablation of atrial tachycardias, atrial flutters, and in atrial fibrillation [5–7].

In this issue of the journal, Gagyi et al. report their experience on the use of this non-contact mapping system with the addition of robotic magnetic navigation and catheter ablation of patients with atrial tachycardias and compared this to a historical control group [8]. From a total of 70 patients with different atrial tachycardias and atrial flutter, the group reported an acute success rate of 94% with similar outcomes in focal versus reentrant tachycardias as well as left and right atrial arrhythmias. Compared to a historical control group using a commercially available mapping system and remote magnetic navigation system, the novel system reports similar fluoroscopy use and number of radiofrequency applications or duration, but longer procedural time albeit with better acute and midterm success rates and similar complication rates. As previously reported by the same group of investigators, they claim that the longer procedural time is associated with a steeper learning curve with the novel remote magnetic navigation system [9].

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It is worth highlighting that implementation of the non-contact mapping catheter to the remotely navigated environment using the presented approach still requires substantial activity of the physician in the operational area. Since the remote navigation addresses only dedicated ablation catheter, all the maneuvers with the basket catheter are performed manually by the operator. This leads to increased involvement of the operating team at least during the mapping process itself, which somehow minimizes overall benefits of the use of remote navigation during the case.

There are several other aspects of this report that are worth discussing. First, since the comparison was performed with a commercially available magnetic-based remote navigation system, it will require further investigation how much the remote navigation capabilities add to the overall safety, effectiveness, and efficiency workflow. Second, the accuracy of the activation maps and unveiling of the arrhythmia mechanisms based solely non-contact mapping, in the setting of remotely-controller ablation catheter, may also need further assessment.

The advancements in clinical and invasive cardiac electrophysiology are always welcome and are very gratifying to witness. This makes our passion for the field each time stronger. The quest for the perfect electroanatomical mapping system in combination with remote navigation is still in process. The ideal system will combine ease of use, fast speed, and capability to map different arrhythmias simultaneously, provide reliable information on the underlying arrhythmia mechanism, and reveal adequate targets for ablation. Hopefully someday in the future, such ablation will be performed using the same standardized platform which will keep the operators away from the operating field, without compromising patient's safety, throughout the whole procedure.

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