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EDITORIAL COMMENT

Epicardial mapping and ablation of arrhythmias: is magnetic navigation the answer we have been waiting for?

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Endocardial catheter ablation for cardiac arrhythmias has emerged as a powerful treatment over the last decades. Supraventricular tachycardias such as for example AV nodal reentrant tachycardias, circus movement tachycardias making use of an accessory bundle and right-sided, cavotricuspid dependent atrial flutters can be treated with a success rate close to 100 %. However, with the emerging technology, the field is widening and more complex arrhythmias are being treated, with a less robust outcome and endpoint. The arrhythmogenic substrate may not always be confined to or modifiable via an endocardial approach. For ventricular arrhythmias in the setting of dilated cardiomyopathy, arrhythmogenic right ventricular cardiomyopathy (ARVC), previous myocardial infarction or myocardial storage disorders, an epicardial substrate may be crucial for arrhythmia perpetuation, and consequently an epicardial approach may be warranted for ablation. Epicardial procedures are usually performed after failed endocardial ablation, their number is steadily growing, and in experienced hands these procedures appear efficacious and safe [1, 2].

Damage to the coronary vessels is a potential complication of epicardial mapping radiofrequency ablation. To prevent this, (repeated) coronary angiography can be performed, which adds to the radiation burden. Alternatively, scar anatomy and coronary vasculature can be imaged using cardiac MRI. Navigation systems such as the CARTO system may facilitate epicardial mapping by merging imaging techniques with the electroanatomical map, in which critical structures can be further annotated [3]. Furthermore, they may assist in reducing radiation exposure to both the operator and the patient.

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Anatomical barriers associated with epicardial ablation include problematic pericardial access through a subxiphoid approach, puncture of the right ventricle in 10–14 %, and potential manoeuvrability problems in case of adhesions within the pericardium [4]. Indeed, it was shown that epicardial ablation was associated with a failure percentage of the procedure of 10–11 %, of which 75–87 % due to pericardial adhesions after cardiac surgery [1, 4].

In this issue of the *Netherlands Heart Journal*, Abraham et al. present three patients, all under general anaesthesia, where a magnetic navigating system (MNS) was used to complement epicardial mapping and ablation [5]. The first patient is a 78-year-old man with episodes of ventricular tacycardia from an inferior myocardial infarction scar. The second patient is a 50-year-old man with symptomatic, idiopathic premature ventricular complexes, arising from an epicardial site close to the left main stem coronary artery. A third patient had a left lateral accessory pathway, of which the insertion site could not be determined with an endocardial approach because of perimitral block after previous ablations. In this specific case, endocardial ablation was employed after localisation of the bypass tract was confirmed epicardially. Hence, these three patients form an atypical population for epicardial ablation.

Abraham et al. confirm that MNS can be used for epicardial mapping, as has been demonstrated by others [1, 6]. However, several issues remain unsolved and may be the subject of further studies. First, the most important motivation to employ an MNS is the reduction of radiation for both the operator and the patient. In the three patients that Abraham et al. describe, the amount of radiation is considerable, 46 min on average, with a cumulative fluoroscopy time up to 84 min in patient 3. Additionally, in this study, repeat coronary angiograms were performed after every radiofrequency ablation application, which is not specific for MNS-guided ablation, but does not add to reduction of radiation exposure either. Although the authors state that in the literature the amount of radiation using

MNS is less than using conventional mapping, [4, 6] this statement holds true for their two ventricular arrhythmia cases only and cannot be substantiated without a head-to-head comparison. Similarly, it is not indicated that epicardial mapping is less time-consuming than conventional catheter mapping. The use of dedicated multi-electrode catheters such as the Pentaray catheter, for example, may even be associated with a more rapid, higher resolution, mapping procedure, although this also has to be proven in a clinical comparison. Thirdly, it remains open to debate whether MNS provides a better epicardial tissue contact. One might even speculate that manoeuvrability within the pericardial space is even less efficient than manual catheter ablation, since the pericardium itself may possess a random resistance to the mapping catheter.

Finally, it remains to be solved whether truly difficult epicardial cases, such as after cardiothoracic surgery, can be handled more easily using MNS than with conventional techniques. Indeed, of the failed epicardial access cases reported earlier, the vast majority were related to postoperative pericardial adhesions [1, 4]. It could be argued that such adhesions would need careful dissection using steerable sheaths, as has been demonstrated previously, [7] and that MNS is of little added value here. Again, studies comparing different techniques are so far lacking. Furthermore, patients who underwent coronary bypass grafting were excluded from most studies on epicardial ablation because of the risk of damaging coronary grafts. However, this patient group may represent the true last frontier for epicardial mapping and ablation, and potentially MNS could be of use in this patient group.

Abraham et al. modestly conclude that magnetic navigation for epicardial mapping and ablation may offer benefits, but that more cases are required to actually prove this. Apart from the conclusion that magnetic epicardial navigation can be done, we must await further data to be able to understand the specific indication for this technique in epicardial mapping and ablation of arrhythmias.

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