It is time to revisit the theory of acute conduction block: efficacy of high-intensity focused ultrasound epicardial ablation

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We have read with great interest the study by Pozzoli et al. \cite{1}, which presented the in vivo assessment of pulmonary vein isolation (PVI) after open chest epicardial high-intensity focused ultrasound ablation (HIFU). The authors observed that up to 3 weeks after surgery, PVI was not achieved using the HIFU epicardial ablation system. Interestingly, this important finding was not correlated with the 100% absence of recurrence of atrial fibrillation (AF) at 1-year follow-up.

Traditionally, the first 3-month period after an ablation procedure is called the ‘blanking’ period. During this period, any assessment of efficacy is questionable because of the scarring and healing occurring in the heart. It is stated in the manuscript that...
the clinical success of AF ablation depends on persistent blocking of electrical conduction across the ablation lines. With bipolar radiofrequency (RF) clamps, the PV cuff is physically clamped and burned repeatedly in order to achieve ‘acute’ conduction block. A question for further reflection is: are we achieving block at that moment because of local tissue trauma and inflammation resulting from simultaneous crushing and burning of the PV cuff and is that block durable? Indeed, Benussi et al. [2] have shown previously that despite achieving block acutely with bipolar RF clamps, the veins often recover their ability to conduct (at 3 weeks in 15% of ablated patients).

It has been hypothesized that HIFU lesions may take time to scar in and mature. The mode of cell death for this energy source may differ from that of RF and thus may not always be instantaneous. Villamizar et al. [3] have demonstrated that HIFU ablation achieved 100% transmurality.

In our experience of using HIFU in 70 cases, we have observed thought-provoking clinical results. The freedom from recurrence of AF after ablation was 82% at 1 month, 90% at 1 year and 100% at 3 years in patients presenting with preoperative paroxysmal AF and undergoing concomitant open heart cardiac surgery with creation of only a box lesion and no additional ablation lines. Those patients were also free from anti-arrhythmic drugs at the time of follow-up. Those impressive results, however, were not observed in patients presenting preoperatively with permanent AF, showing a freedom from recurrence of AF of 42% at 1 month, 54% at 1 year and 62% at 3 years.

Our experience suggests that in order to achieve good clinical results using the HIFU ablation system it is important to use it in the right patients. In our experience, those patients presented with paroxysmal AF with normal or mildly dilated left atria (area <30 cm²; volume <68 ml). We consider a simple box lesion sufficient to achieve a good postoperative clinical result. In patients with permanent AF, a more complex approach should be applied to treat an evolved histopathological condition of the atria.

We believe that the HIFU epicardial ablation system is a high-performing treatment modality creating transmural lesions in the left atrium and yielding good clinical results. Perhaps it is time to revisit the theory of acute conduction block!

REFERENCES


LETTER TO THE EDITOR RESPONSE

Reply to Colli and Romero-Ferrer

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Colli et al., commenting on the electrophysiological efficacy of high-intensity focused ultrasound (HIFU), propose a revision of the acute conduction block theory, as a means to confirm effective pulmonary veins (PVs) isolation [1, 2].

Although this proposal could be original, albeit not supported by evidence, it is in contrast with the general agreement surrounding the end-points for atrial fibrillation (AF) ablation.

In the areas of consensus on ablation techniques identified by the task force in the recently published Consensus Statement on AF catheter and surgical ablation [3], complete electrical isolation of all PVs should be the goal in every ablation strategy targeting the PVs and/or the PV antrum. So, if the PVs are targeted, electrical isolation should be the goal, and its achievement requires, at a minimum, the assessment and demonstration of conduction block across the PVs lesion. Likewise for surgical PVs, isolation entrance and/or exit block should be validated.

Since such acute validation can overestimate success, the Consensus also suggests an extra period of 20 min following PV isolation, to identify and treat PVs reconduction initially masked by the inflammation process, which gives an apparent acute conduction block.

The evidence supporting the correlation between complete electrical isolation and clinical efficacy of ablation is clear-cut, since the major predictor of arrhythmia recurrence after catheter