

# How an innovative catheter with temperature control and very high-power, short-duration ablation changed our approach to the treatment of persistent atrial fibrillation

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## KEYWORDS

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Microbipolar mapping

Ablation targets of persistent atrial fibrillation remain poorly understood nowadays: due to structural alterations of the left atrium, isolation of the pulmonary veins alone has proved ineffective. New ablation targets such as the posterior wall, coronary sinus, and left atrial appendage were then sought. A new catheter (QDOT Micro™) has recently been released, which has the potential to increase the safety and efficacy of the procedure: it is connected to a new radiofrequency generator that allows for temperature-controlled ablation by reducing power and increasing irrigation with the increase in tissue temperature and allows to deliver power up to 90 W for few seconds (very high-power short-duration).

## General considerations

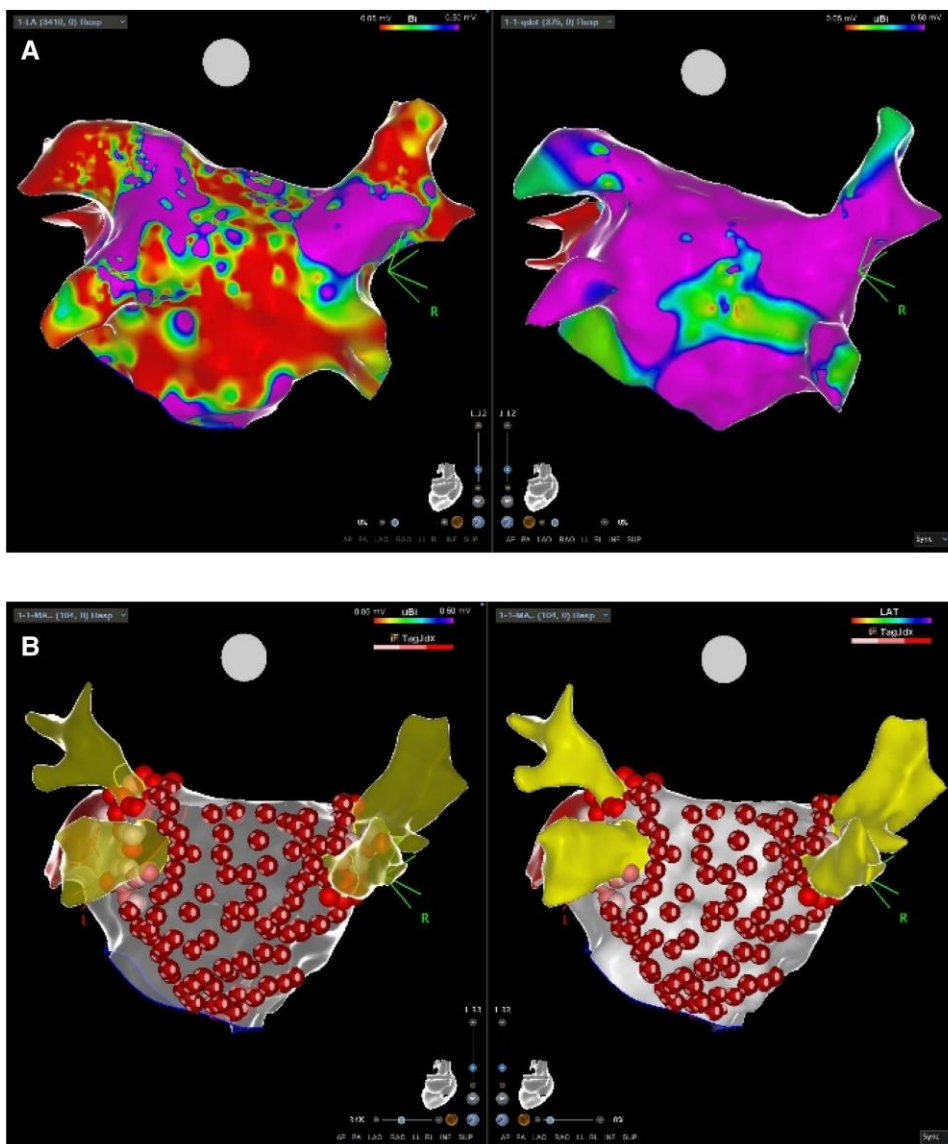
Atrial fibrillation is actually widespread with population ageing. Catheter ablation with isolation of the pulmonary veins has become a well-established technique for the treatment of paroxysmal atrial fibrillation. In 90% of cases, the triggers for paroxysmal atrial fibrillation arise from the pulmonary veins and the electrical isolation of these has been shown to reduce arrhythmic recurrences and improve the quality of life.<sup>1,2</sup> Persistent atrial fibrillation instead has a different mechanism, mostly due to structural left atrial changes and isolation of the pulmonary veins alone has proved to be ineffective.<sup>3,4</sup> New ablation targets were therefore sought such as the posterior wall, the coronary sinus, and the left atrial appendage. However, these

structures are slight and the risk of thermal injury to the tissue with consequent perforation and cardiac tamponade is greater.

## Technology in atrial fibrillation ablation

First, atrial fibrillation ablation involved the elimination of signals inside the pulmonary veins with limited efficacy of the procedure and a high risk of pulmonary vein stenosis. Subsequently, we arrived at the circumferential isolation of the pulmonary veins by radiofrequency, which radically changed the ablation technique.<sup>5</sup> Since then we have moved on to the development of open-irrigated radiofrequency (RF) catheters with real-time contact force sensing capability catheters and use of lesion indices are used for AF ablation with increased safety and efficacy of the procedure.<sup>6-8</sup> They are capable to register temperature using a single thermocouple in the middle of the tip, but the accuracy is not high.<sup>9</sup>

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**Figure 1** Analysis of substrate (Bipolar and MicroBipolar) with microelectrodes (A), PVI and PW ablation (B).

Recently, a novel catheter with new features that can potentially increase safety and efficacy of the procedure has been released. It was designed with microelectrodes that increase the sensibility and the resolution of the near field electrograms of the tissue to a better identification of the signals during the ablation and to a better quality of substrate mapping. Furthermore, it is connected to a new RF generator that allow a temperature-controlled ablation through automatic adjustment of power and fluid output based on real-time temperature measurement.

Furthermore, this ablation mode allows to delivery powers up to 90 W for 4 s. This ablation modality is called very high-power short-duration, and it creates wider but shallower lesion with reduction of damage to surrounding tissues. It has been tested in some studies and appears to be safe and effective for the isolation of pulmonary veins.<sup>10-12</sup> Actually some studies report safety of HP-SD and vHP-SD only for PVI in patient with paroxysmal AF,

and the complications rate were generally low. The six thermocouples of the QDOT catheter enable temperature control, power and irrigation modulation to potentially avoid tissue overheating, steam pops and damage to surrounding tissues. PVI with HP-SH ablation (50 W with target AI of 350 on the posterior segment) without oesophageal temperature monitoring can potentially cause oesophageal lesions.<sup>13</sup> However, in this study, oesophageal lesions were identified endoscopically the day after the procedure and to date there are no studies identifying oesophageal lesions after vHP-SD ablation mode. Another innovation that led the QDOT catheter is the possibility to visualize voltage maps using the microelectrodes on the tip of the catheter. Actually PWI seems to be useful in patients with persistent AF. The voltage map of the left atrium plays a fundamental role in the treatment of persistent AF and demonstrates how substrate modifications can play an important role in the arrhythmic recurrence of the patient with persistent AF.

Actually, there is no evidence regarding microbipolar mapping for the characterization of the substrate of the left atrium in patients with persistent AF.

### Persistent atrial fibrillation ablation

Nowadays, persistent atrial fibrillation ablation is a procedure that does not have a high efficacy, and the ablations in slighter structures expose the patient to greater risks and complications than the isolation of the pulmonary veins alone.<sup>14</sup> Ablation of these structures such as the coronary sinus, posterior wall and left atrial appendage significantly increases the duration of the procedure and radiofrequency time and the exposure of the patient and the operator to ionizing radiations. In this setting, the use of this catheter for isolation of the posterior wall of the left atrium could change the approach of the ablation technique (Figure 1).

Nowadays, there are no studies regarding the efficacy and safety of a very high-power short-duration ablation on the posterior wall of the left atrium for ablation of persistent AF. As regards the sensitivity of the microelectrodes for substrate analysis, there are no comparison studies with high-density catheters.

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### Data availability

No new data were generated or analysed in support of this research.

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