

# Current ablation techniques for persistent atrial fibrillation: results of the European Heart Rhythm Association Survey

**Nikolaos Dagres<sup>1</sup>\*, Maria Grazia Bongiorni<sup>2</sup>, Torben Bjerregaard Larsen<sup>3</sup>, Antonio Hernandez-Madrid<sup>4</sup>, Laurent Pison<sup>5</sup>, and Carina Blomström-Lundqvist<sup>6</sup>**  
**Conducted by the Scientific Initiatives Committee, European Heart Rhythm Association**

<sup>1</sup>Second Department of Cardiology, University of Athens, Greece; <sup>2</sup>CardioThoracic and Vascular Department, University Hospital-Pisa, Italy; <sup>3</sup>Department of Cardiology, Aalborg University Hospital, Aalborg, Denmark; <sup>4</sup>Cardiology Department, Ramon y Cajal Hospital, Alcalá University, Madrid, Spain; <sup>5</sup>Department of Cardiology, Maastricht University Medical Center, Maastricht, The Netherlands; and <sup>6</sup>Department of Cardiology, Institution of Medical Science, Uppsala University, Uppsala 75185, Sweden

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The aim of this survey was to provide insight into current practice regarding ablation of persistent atrial fibrillation (AF) among members of the European Heart Rhythm Association electrophysiology research network. Thirty centres responded to the survey. The main ablation technique for first-time ablation was stand-alone pulmonary vein isolation (PVI): in 67% of the centres for persistent but not long-standing AF and in 37% of the centres for long-standing persistent AF as well. Other applied techniques were ablation of fractionated electrograms, placement of linear lesions, stepwise approach until AF termination, and substrate mapping and isolation of low-voltage areas. However, the percentage of centres applying these techniques during first ablation did not exceed 25% for any technique. When stand-alone PVI was performed in patients with persistent but not long-standing AF, the majority (80%) of the centres used an irrigated radiofrequency ablation catheter whereas 20% of the respondents used the cryoballoon. Similar results were reported for ablation of long-standing persistent AF (radiofrequency 90%, cryoballoon 10%). Neither rotor mapping nor one-shot ablation tools were used as the main first-time ablation methods. Systematic search for non-pulmonary vein triggers was performed only in 10% of the centres. Most common 1-year success rate off antiarrhythmic drugs was 50–60%. Only 27% of the centres knew their 5-year results. In conclusion, patients with persistent AF represent a significant proportion of AF patients undergoing ablation. There is a shift towards stand-alone PVI being the primary choice in many centres for first-time ablation in these patients. The wide variation in the use of additional techniques and in the choice of endpoints reflects the uncertainties and lack of guidance regarding the most optimal approach. Procedural success rates are modest and long-term outcomes are unknown in most centres.

## Keywords

Atrial fibrillation • Persistent • Catheter ablation • EHRA survey • EP Wire

## Introduction

Catheter ablation is now well established treatment option for atrial fibrillation (AF), with rising numbers of procedures conducted worldwide.<sup>1</sup> Patients with persistent AF represent a significant proportion of ablation candidates. Ablation of this type of arrhythmia poses particular challenges because of the modest success rates<sup>2</sup> which may be related to more advanced atrial remodelling. In addition to electrical isolation of the pulmonary veins (PVI), which has become the standard for ablation of all types of AF, several additional ablation strategies have been proposed for patients

with persistent AF in order to improve the outcome.<sup>2–6</sup> However, recent data question the established ablation techniques<sup>7</sup> and the optimal strategy in these patients remains unknown resulting in a wide variation of applied techniques in daily practice. The aim of this survey was to provide an insight into current ablation strategies for persistent AF across Europe.

## Methods and Results

Thirty centres, which are members of the European Heart Rhythm Association (EHRA) electrophysiology (EP) research network,

\* Corresponding author. Tel: +49341865252612. E-mail address: nikolaosdagres@yahoo.de

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responded to the survey. There was a wide geographic distribution of the responding centres from 16 countries (6 centres from Italy, 4 each from Denmark and Germany, 2 each from Netherlands, Spain, and the United Kingdom, and one centre from 10 other countries). The majority (77%) of the responding centres was university hospitals.

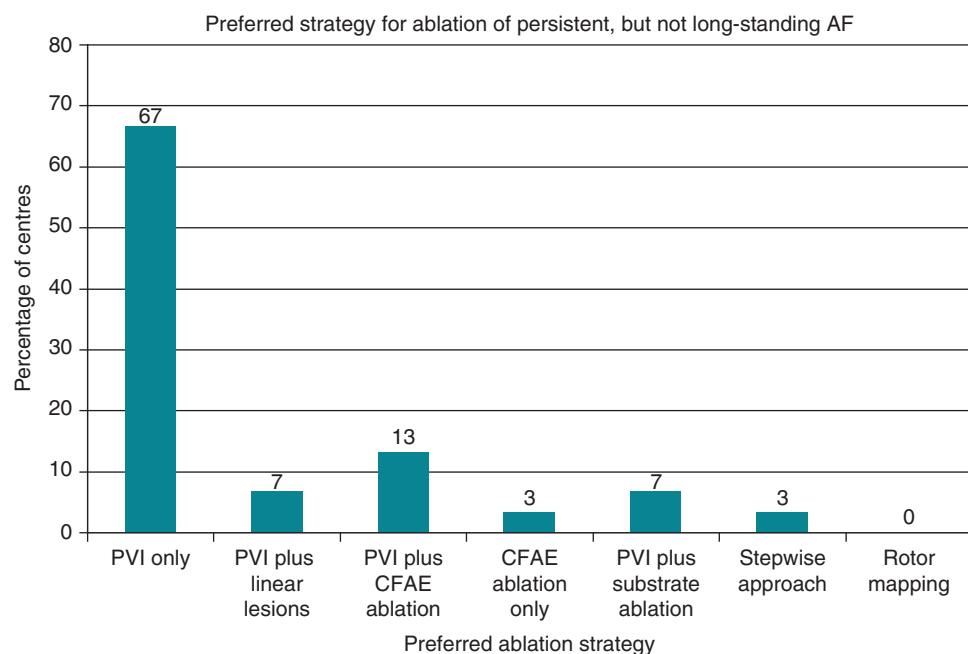
There was a large spectrum of the responding centres from low to high volume regarding the number of ablation procedures per year: 7% of centres performed  $<100$  catheter ablations (for all indications) in the last calendar year, 20% of the centres performed 100–199 procedures, 23% of the centres performed 200–399 procedures, and 50% of the centres performed  $\geq 400$  catheter ablations. The corresponding numbers for left atrial ablation were: 17% of the centres performed  $<50$  left atrial ablations, 20% of the centres performed 50–99 procedures, 20% of the centres performed 100–199 procedures, and 43% of the centres performed  $\geq 200$  left atrial ablations in the last calendar year. The majority of ablations (57%) was for paroxysmal AF, 32% for persistent AF, and 12% for long-standing persistent AF.

The main ablation technique in patients undergoing first-time ablation for persistent but not long-standing AF was stand-alone PVI in the majority of the centres (67%) (Figure 1). The next most commonly used technique was ablation of fractionated electrograms, either as an addition to PVI (13%) or as a stand-alone procedure (3%). Other techniques employed as the main ablation strategy in this patient population were reported by very few centres: PVI plus substrate mapping and isolation of low-voltage areas by 7%, PVI plus linear lesions such as roof or mitral isthmus lines by 7%, stepwise approach until AF termination by 3%, whereas no centre performed rotor mapping as the main first-time ablation strategy.

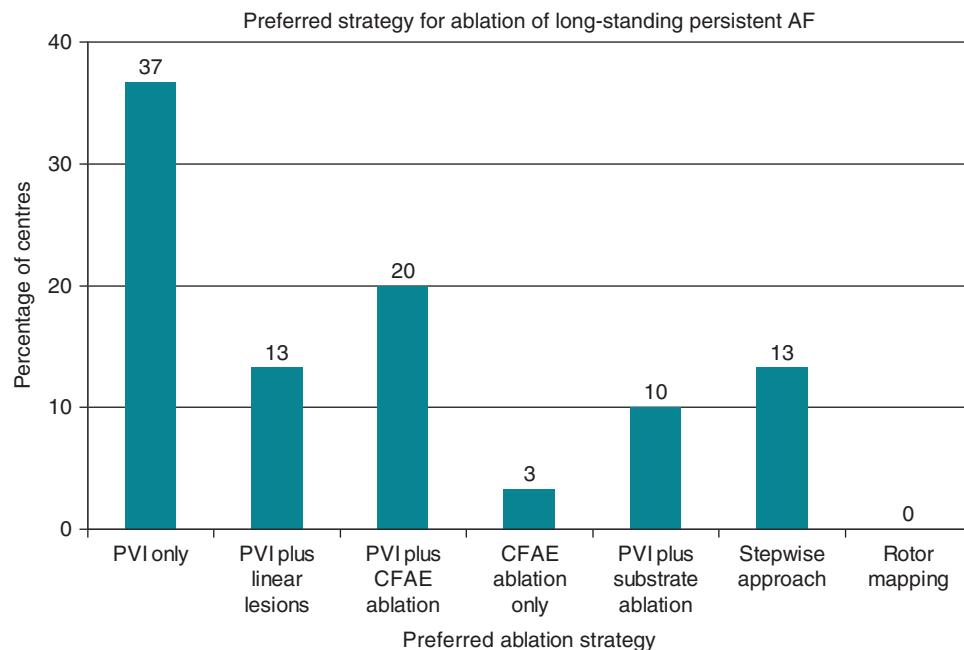
A more aggressive approach was used for first-time ablation in patient with long-standing persistent AF (Figure 2): stand-alone PV remained the most widely applied strategy, but was reported by only 37% of the respondents. The next most frequently used technique was ablation of fractionated electrograms, either as an addition to PVI (20%) or as a stand-alone procedure (3%). Other techniques were: stepwise approach until AF termination (13%), PVI plus linear lesions such as roof or mitral isthmus lines (13%), PVI plus substrate mapping and isolation of low-voltage areas (10%), whereas one centre (3%) did not perform AF ablation in such patients. Again, none of the centres reported using rotor mapping as part of the first-time ablation strategy as a stand-alone procedure or as an addition to PVI.

When stand-alone PVI was performed in patients with persistent but not long-standing AF, the majority (80%) of the centres used an irrigated radiofrequency ablation catheter and 20% of the respondents used the cryoballoon. The results were similar for the techniques applied in patients with long-standing persistent AF if stand-alone PVI was the chosen ablation method: again, the majority (90%) of the centres used an irrigated radiofrequency ablation catheter, whereas the cryoballoon was used by 10% of the centres as the main technique. The laser balloon and radiofrequency based one-shot ablation and mapping-style catheters were not used in any of the responding centres as the main ablation tool for stand-alone PVI.

We also asked whether the centre's strategy for ablation of persistent AF had been affected by the recent results of the STAR-AF (Substrate and Trigger Ablation for Reduction of Atrial Fibrillation) II trial. More than half (53%) responded that they had been affected either moderately so that PVI alone was now used in most patients



**Figure 1** Preferred strategy for first ablation of persistent, but not long-standing AF. CFAE, complex fractionated atrial electrogram; PVI, pulmonary vein isolation; stepwise approach, stepwise approach until termination of AF; substrate ablation, substrate mapping and isolation of low-voltage areas.



**Figure 2** Preferred strategy for first ablation of *long-standing persistent AF*. CFAE, complex fractionated atrial electrograms; PVI, pulmonary vein isolation; stepwise approach, stepwise approach until termination of AF; substrate ablation, substrate mapping and isolation of low-voltage areas.

without extensive atrial substrate disease (27%), or significantly so that ablation of fractionated electrograms or linear lesions was no longer applied in contrast to their frequent previous application (17%) or now performing PVI alone compared with their extensive ablation procedures prior to the trial (10%). In contrast, 47% of the centres responded that they had not been affected by the trial results, either because PVI alone had already been the main ablation strategy in these patients before the publication of the STAR-AF II trial results (33%) or because there was only one trial available and the respondents still believed that more extensive ablation would be necessary for this type of AF (13%).

Equipment for rotor mapping was available in only one centre (3%). The main reasons for not using this technique were lack of belief in its value (43%) or lack of financial resources (33%).

Regarding right atrial ablation lesions including lesions in the right atrium, the superior vena cava, the coronary sinus, etc., 53% of the respondents reported not performing them at all or only in isolated cases, and only 13% applied such ablation lesions in  $\geq 20\%$  of the cases. Systematic detection of non-pulmonary vein triggers was also performed only by a minority: 10% of the centres reported to systematically search for such triggers with isoproterenol and then target them. A further 27% reported search attempts but only in a minority of cases.

In redo ablation procedures, if re-conduction in the pulmonary veins was detected, the main strategy was to maintain the primary ablation strategy and re-isolate the pulmonary veins in 60% of the centres. The remaining 40% of the respondents either expanded the previous strategy by adding ablation of complex fractionated atrial electrograms or linear lesions in the left atrium (23%) or customized the ablation approach depending on the patient's response to

the previous ablation or considered thoracoscopic AF ablation including PVI and box lesion (17%).

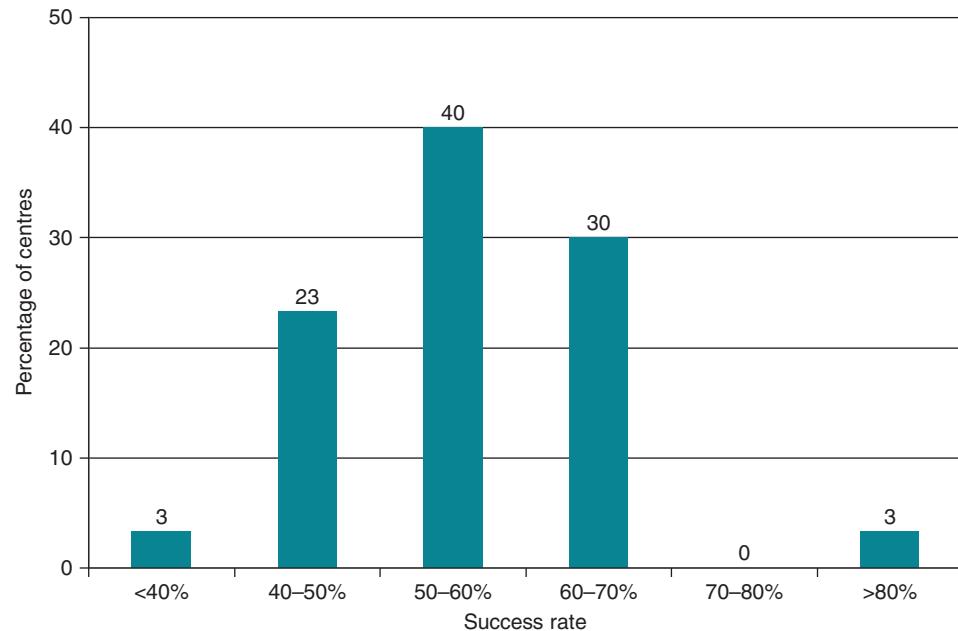
For first-time ablation of persistent AF, 59% of the centres did not use a specific endpoint once the ablation strategy was fulfilled, whereas 24% used AF termination during the procedure as an endpoint, and a further 17% used the criterion of non-inducibility of AF under provocative manoeuvres with adenosine or isoproterenol after cardioversion.

The approximate overall success rate after a single catheter ablation for persistent AF at 1 year, defined as the percentage of patients remaining free from recurrences off antiarrhythmic drugs, was reported to be 50–60% in 40% of the centres (Figure 3). Only the minority of the centres (27%) knew their 5-year results; other centres did not have such long-term follow-up in patients undergoing ablation. A quality registry for ablation procedures was used in 9 of the 16 countries (56%) but in only 2 of these countries the participation was compulsory.

## Discussion

The main findings of this survey were a shift towards simpler ablation methods such as stand-alone PVI as the primary choice for persistent AF in many centres and a wide variation in the use of additional techniques and selection of endpoints, reflecting the uncertainty regarding the optimal ablation approach in these patients.

Patients with persistent AF (long-standing and not long-standing) represent a significant portion of patients undergoing AF ablation (43%) as was evident in the present survey. These patients usually have a poorer outcome after catheter ablation compared with patients with paroxysmal AF, which is generally thought to be a



**Figure 3** The overall success rate after a single catheter ablation for persistent AF, defined as freedom from AF recurrences whilst off antiarrhythmic drugs.

consequence of more advanced structural changes that take place in the left atrial myocardium as AF progresses from the paroxysmal to the persistent form.<sup>8</sup> Therefore, more extensive ablation strategies have been employed in persistent AF. Thus, PVI is generally considered sufficient for paroxysmal AF, whereas in the persistent form various additional ablation strategies have been proposed: linear ablation lesions in the left atrium with the goal to place anatomical barriers to the wavefront of the arrhythmia within the atrium, targeting the complex fractionated atrial electrograms, detection and targeting the arrhythmia rotors in the atria, and additional targeting the right atrial sites, or substrate ablation by voltage mapping of the left atrium and isolation of low-voltage areas.<sup>2–6</sup>

However, recent data have questioned the value of these additional ablation techniques. In the multicentre, randomized STAR-AF II trial,<sup>7</sup> stand-alone PVI has been shown to produce similar results regarding the prevention of recurrences of AF or atrial tachycardia compared with PVI plus linear lesions or PVI plus targeting of fractionated electrograms in patients with persistent AF. Thus, not surprisingly, stand-alone PVI was the main ablation strategy for first-time ablation in 67% of the centres for persistent, not long-standing AF and in 37% of the centres even for long-standing persistent AF. Indeed, more than half of the centres reported to have been influenced by the results of the STAR-AF II trial when selecting their ablation strategy and reported performing more stand-alone PVI procedures and abandoning additional techniques.

In line with this general approach to keep the ablation strategy relatively simple, in patients with pulmonary vein re-conduction, the majority (60%) of the centres maintained the primary ablation strategy and closed the gaps of the previous ablation lesions. Nevertheless, PVI alone does not produce the satisfactory results in this subset of patients. The recurrence rates remain high, which was confirmed in

the present survey where the most frequently reported 1-year success rate after ablation for persistent AF was 50–60%.

There was a wide variation in the use of additional techniques, and none of them was applied by more than 25% of the centres during first-time ablation. Interestingly, rotor mapping was not reported to be the main ablation strategy by any centre; neither for persistent AF nor for long-standing persistent AF, and required tools or equipments were unavailable in the vast majority of the responding centres.

Similar variations were observed regarding the application of the right atrial ablation lesions, the detection of non-pulmonary vein triggers with pharmacological provocation, or the endpoint of the ablation procedure reflecting the uncertainties regarding the optimal ablation methods in these patients.

The overall success rate as reported by the centres was modest, mostly between 50 and 60% and thus in line with published reports. However, almost three quarters of the centres did not know their 5-year results of their ablation procedures for persistent AF because they did not have such a long-term follow-up after AF ablation. More extensive follow-up of patients who have undergone ablation for AF may provide additional information and contribute to more successful application of available methods.

## Conclusions

Patients with persistent AF represent a significant proportion of patients undergoing ablation for AF in Europe. There seems to be a shift towards simpler ablation methods with stand-alone PVI being the primary choice for first-time ablation in many centres. The wide dispersion in the use of additional techniques and in the choice of endpoints reflects the uncertainties regarding the optimal

approach. Procedural success rates are modest and long-term outcomes are unknown in most centres.

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