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EHRA SURVEY

The blanking period after atrial fibrillation ablation: an European Heart Rhythm Association survey on contemporary definition and management

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Abstract

The use of a blanking period (BP) after an atrial fibrillation (AF) ablation procedure is a common practice, but recent data questions the benign nature of early recurrences of atrial tachyarrhythmias (ERATs). A physician-based survey was carried out by the European Heart Rhythm Association (EHRA) to investigate the current definition and applicability of BP and ERAT management. An online questionnaire was sent to clinical and interventional electrophysiologists. A total of 436 respondents (88% interventional electrophysiologists) reported observing ERATs in 25% (interquartile range 15–35) of patients, less commonly in paroxysmal AF (PAF) compared with persistent AF (persAF). The median reported duration of BP used by respondents was 90 days, with 22% preferring a shorter BP duration for PAF patients compared with persAF. Half of the patients with ERATs are expected to also experience late recurrences (LR). Isolated episodes of ERATs are treated conservatively by 99% of the respondents, but repeat ablation during the BP is preferred by 20% of electrophysiologists for multiple ERATs and by 16% in patients with organized atrial tachyarrhythmias. In conclusion, ERATs are commonly observed after AF ablation, particularly in persAF patients, and are perceived as predictors of LR by half of the respondents. A general adherence to a 90-day BP duration was observed. During this time period, ERAT is mainly treated conservatively, but repeat ablation during the BP is occasionally offered to patients with multiple ERATs and those with organized atrial tachyarrhythmias.

Keywords Atrial fibrillation • ablation • blanking period • recurrence • EHRA survey

Introduction

Atrial fibrillation (AF) is the most common sustained arrhythmia and its incidence is increasing with the ageing of the population.[1] Catheter ablation of AF has emerged as an effective therapeutic option once a rhythm control strategy is chosen.[2]

Early recurrence of atrial tachyarrhythmias (ERATs) within 90 days after an AF ablation procedure is a recognized phenomenon.

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What's new?

- We report details on blanking period (BP) duration and on frequency and management of early recurrences of atrial tachyarrhythmia (ERAT) in the largest physician-based survey focusing on BP after atrial fibrillation (AF) ablation.
- Early recurrences of atrial tachyarrhythmias are perceived to occur in 25% of patients, more often in persistent AF than paroxysmal AF patients.
- Late recurrences are perceived to occur in a median of 50% of patients with ERAT.
- Most respondents use a 90-day BP, although almost 25% recommend to shorten BP in patients with paroxysmal AF.
- Early re-ablation during BP is most often performed in patients with multiple episodes of ERATs and in those with organized atrial tachyarrhythmias.

However, the long-term clinical significance of ERATs remains unclear. Early recurrences of atrial tachyarrhythmias may be caused by transient pro-arrhythmogenic ablation-induced inflammation, but many other mechanisms [transient ischaemia, oxidative stress, oedema, proliferative tissue repair, autonomic imbalance, interruption of antiarrhythmic drugs (AAD)] may be involved.[3,4]

The observation that atrial arrhythmias may transiently occur in the first few months after ablation led to a consensus in using an arbitrary 90-day window, defined as the blanking period (BP), where ERAT is not considered as treatment failure.[5] However, recent studies questioned the clinical significance of ERATs and what the duration of BP should be, suggesting a role of ERAT in predicting late arrhythmic recurrences.[6,7]

The aim of this physician-based survey performed by the Scientific Initiatives Committee (SIC) of the European Heart Rhythm Association (EHRA) was to assess the physician's perception on the rate of ERATs during BP, the appropriate duration of BP, and the current management of early recurrences.

Methods

This survey consisted of 26 multiple-choice questions or sliders for numerical inputs.

The survey was mainly distributed among EHRA members, disseminated among members of European national rhythm groups, and promoted through social media by the EHRA President and the members of SIC. The document including the full questionnaire can be found in Supplementary material online, *Material S1*.

The survey was structured in four parts. The first section aimed to define the respondent's background and experience, with questions regarding the volume of interventions performed in the centre and by the operator, as well as additional questions assessing the preferred strategy for ablation of paroxysmal AF (PAF) and persistent AF (persAF). In the second part of the survey, the duration of BP and incidence of early recurrences were asked. Digital sliders were preferred to numerical entries to detect small differences in the suggested duration of BP and in the rate of recurrences. In the third section, we aimed to investigate the management of ERATs with focus on re-ablation, medical treatment, and use of AAD. The fourth section addressed the respondents' opinions on explanations for BP recurrences or late cure.

The questionnaire aimed to highlight the general perception on the rate of ERATs, their meaning, and management. Analysis of correlation among the different sections was pre-specified to highlight differences in BP duration and ERAT interpretation among operators with different experiences or different preferred ablation strategies.

Statistical analysis

After testing results for normality (Shapiro–Wilk test), continuous variables with normal distribution are presented as mean ± standard deviation, otherwise as median [interquartile range (IQR)]. These variables were compared with the Student *T*-test or the Mann–Whitney test, as appropriate. Categorical variables were compared using the χ^2. All analysis was performed using Graphpad Prizm 8 or SPSS statistic software version 28.

Three sub-analyses were predefined: a comparison of BP duration between high volume (HV; ≥50) and non-HV operators (nHV; <50 AF Ablations per year—operators were classified according to procedural volume on the basis of available guidelines[8]); a comparison between operators using radiofrequency current (RFC) preferentially vs. the cryoballoon (CB); and a comparison between ablation strategies including only pulmonary vein isolation (PVI) vs. PVI associated with additional left atrial lesions (PVI +). The results are presented separately for both PAF and persAF.

Results

Four-hundred and thirty-six physicians participated in the survey. Details on respondents are summarized in *Table 1*: 78% declared performing AF ablation as a primary operator, 10% as a secondary operator, and 12% are non-interventional electrophysiologists. Seventy percent of respondents are working in HV centres (>100 AF ablations per year) and 53% are performing more than 50 AF ablations per year. A total of 81% are independent electrophysiologists, including 60% with more than 5 years of experience in interventional electrophysiology.

When asked to indicate the preferred ablation strategy in PAF, 95% of the respondents chose a PVI-only strategy: 57% with RFC and a 3D mapping system, 42% using the CB, 1% using other single-shot devices. Five percent of respondents declared performing substrate modification (with additional lines or electrogram-based ablation) even during the first procedure for PAF. For persAF ablation, the rate of respondents indicating PVI-only procedures fell to 54% (61% with RFC, 37% with the CB, 2% with other devices), with the rate of operators performing substrate modification rising to 46%. Overall, 63% of the participants declared initiating or continuing AAD therapy after ablation, but more than half of these (57%) used AADs for the duration of BP only.

Duration of the blanking period and the observed rate of early recurrences of atrial tachyarrhythmias

The definition of BP duration was not uniform throughout centres, with 32% of the respondents reporting different definitions used by different operators in the same centre.

The reported median rate of ERATs during BP was 25% (IQR 15–35), with persAF patients perceived as experiencing ERAT more often compared with PAF patients [30% (IQR 20–40) vs. 20% (IQR 10–30), $P < 0.001$; *Figure 1*]. Across all respondents, the

Table 1 Experience in AF ablation of the survey participants

Operators performing AF ablation	
Primary operator	78%
Secondary operator	10%
Not performing AF ablation	12%
Centre volume (number of AF ablation per year)	
0–50	10%
51–100	20%
100–400	47%
>400	23%
Operator volume (number of AF ablation per year)	
0–25	28%
26–50	19%
51–150	37%
>150	16%
Level of training	
Cardiologist in training	10%
Electrophysiologist in training (fellowship)	9%
Electrophysiologist <5 years experience	21%
Electrophysiologist >5 years experience	60%
Preferred strategy for ablation of paroxysmal atrial fibrillation	
PVI only with radiofrequency current and 3D mapping system	54%
PVI only with cryoballoon	40%
Other single-shot devices for PVI only	1%
PVI + substrate modification with radiofrequency current and 3D mapping system	5%
Preferred strategy for ablation of persistent atrial fibrillation	
PVI only with radiofrequency current and 3D mapping system	33%
Cryoballoon PVI only	20%
Other single-shot devices for PVI only	1%
PVI + substrate modification with radiofrequency current and 3D mapping system	43%
Cryoballoon PVI + cryoablation of left atrial posterior wall	3%

indicated BP duration had a median value of 90 days (IQR 60–90). Although the median used BP duration was identical between PAF and persAF patients, 22% of the interviewed electrophysiologists indicated a shorter BP for PAF patients compared with those with persAF, resulting in a wider distribution in the former [PAF 90 (60–90) days vs. persAF 90 (89–90) days; *Figure 2*].

Thirty-six percent of operators declared screening asymptomatic patients for BP recurrences by serial ECG or Holter ECG, while 34% actively screened for ERAT in symptomatic patients only and 30% did not perform any screening during BP.

Perception of the clinical significance of early recurrences of atrial tachyarrhythmias

According to this survey, 90% of the respondents consider ERATs to be associated with late recurrences (LR). In fact, any ERAT, ERATs after ≥4 weeks, and ERATs after ≥8 weeks were indicated as possible predictors of LRs by 28, 34, and 28% of respondents, respectively. Respondents declared that, in general, 50% (IQR 30–65) of patients with a BP recurrence are expected to experience LR (*Figure 1*).

Management of early recurrences of atrial tachyarrhythmia

The preferred management of first AF recurrences, multiple AF recurrences, or recurrences of atrial tachycardia and typical atrial flutter is shown in *Figure 3*.

Electrical cardioversion with additional (re)-introduction of AAD was the preferred strategy, declared by 62 and 70% of respondents in case of 1 or >1 ERATs recurrences, respectively. A repeat AF ablation procedure during BP was reported as being very rarely used in patients with a single AF recurrence (1%), with an increase to 19% in the presence of multiple ERATs. Atrial tachycardia (excluding typical flutter) was reported as being treated with catheter ablation during BP by 16% of interviewed operators. In the case of typical atrial flutter, catheter ablation was the strategy of choice for 71% of operators (of whom 28% checked for PV reconnection). Most of the respondents chose flecainide and propafenone as AAD of choice for BP recurrences (73%), while 22% declared using amiodarone; sotalol or dronedarone was less used (2.5% each). Anti-inflammatory medication such as colchicine was used by only 13% of respondents, while 77% did not consider anti-inflammatory drugs as having any role in reducing BP recurrences.

Looking at anticoagulation therapy beyond the usual 8-week post-ablation period in patients at low risk for stroke ($CHAS_2DS_2$-VASc 0 in males or 1 in females), one-fourth of operators considered modifying the anticoagulation strategy but only in patients with a history of persistent AF or significantly enlarged atria, while an additional 30% modified their anticoagulation strategy if electrical cardioversion was required.

Possible explanations of the pathophysiological mechanisms of early recurrences of atrial tachyarrhythmias

The inflammation theory (inflammation leading to recurrences even in the presence of sustained PVI) received the highest rate of preference (41%) as a possible explanation for recurrences during BP, followed by the theory of 'AF begets AF' (according to which atrial remodelling may require time after restoring sinus rhythm—21% of respondents).

Additional hypotheses included early PV reconnection leading to recurrences but oedema impeding re-do ablation (17%), transient sympathetic/parasympathetic imbalance after ablation (15%), the possibility of missing a late PV reconnection leading to a delay in the repeat procedure (6%).

For 62% of respondents, the BP should be applied to AF ablation procedures only, whereas 20% considered extending its applicability to all complex ablation procedures including ventricular tachycardia. Finally, only 58% of operators were aware that no specific recommendations about BP recurrences were given in the last European guidelines.

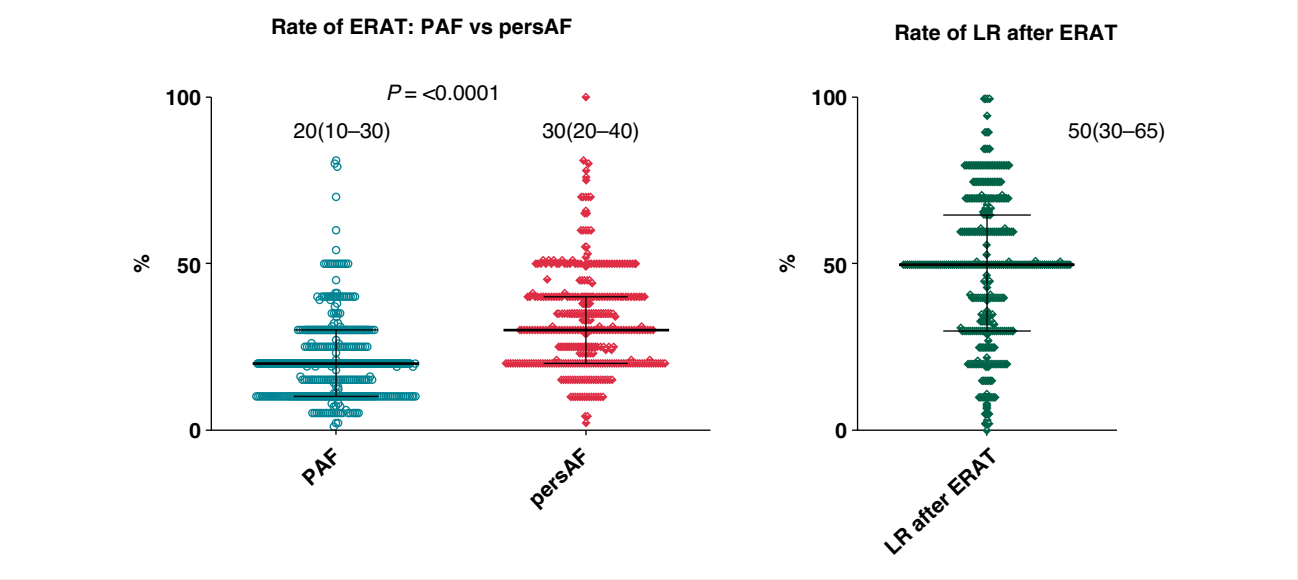

Figure 1 Perceived rates of ERAT in patients treated with ablation for paroxysmal or persistent atrial fibrillation. On the right, perceived rate of late recurrences in patients experiencing ERAT. ERAT, early recurrence of atrial tachyarrhythmias; LR, late recurrence; PAF, paroxysmal atrial fibrillation; persAF, persistent atrial fibrillation.

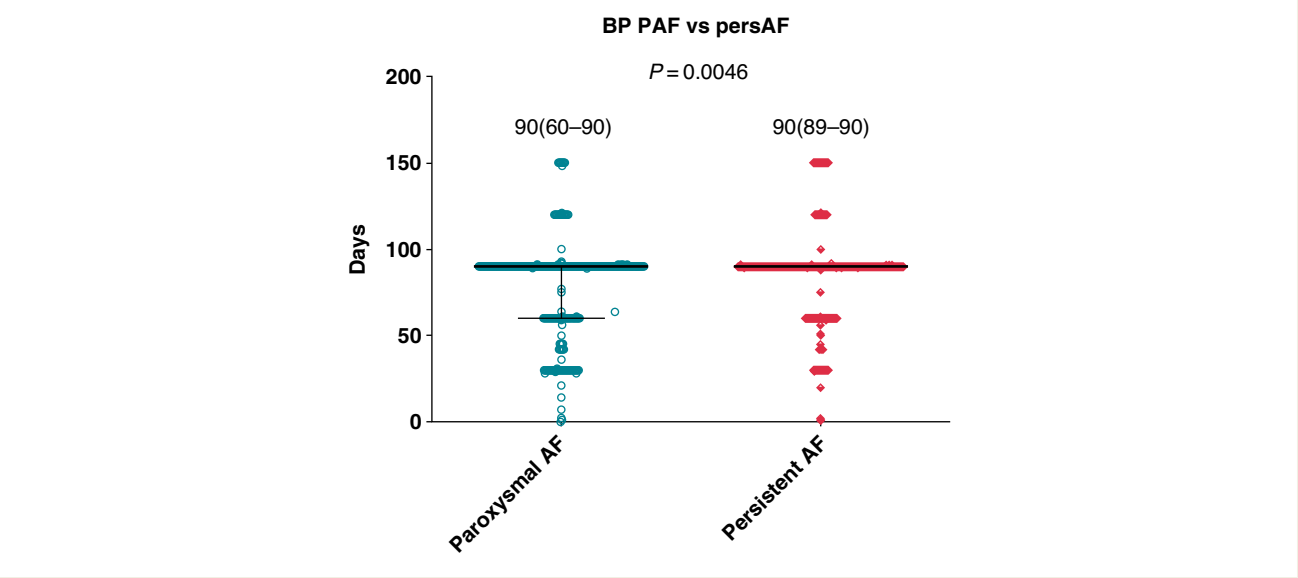

Figure 2 Preferred duration of the blanking period in patients with paroxysmal and persistent atrial fibrillation. AF, atrial fibrillation; BP, blanking period.

Relationship between early recurrences of atrial tachyarrhythmias and operator's experience, energy form, and ablation strategy

Among interventional electrophysiologists, 60% indicated performing more than 50 AF ablation procedures per year and were defined as HV operators. Although the median BP duration was identical between HV and nHV operators, the former more often indicated using a shorter BP in both PAF and persAF patients, resulting in a wider range compared with nHV operators [median of 90 (60–90) days vs. 90 (89–90) days in PAF; 90 (60–90) days vs. 90 (90–90) days in persAF].

During BP, a small difference was observed about the perceived rate of ERAT among HV operators and nHV operators, with HV operators reporting a median 17% (10–25) rate of ERATs in PAF patients and 30% (20–40) in persAF patients, while nHV reported a 20% (15–30) rate for nHV operators and 35% (23–40) in persAF. Both groups of operators indicated a similar rate of LR following

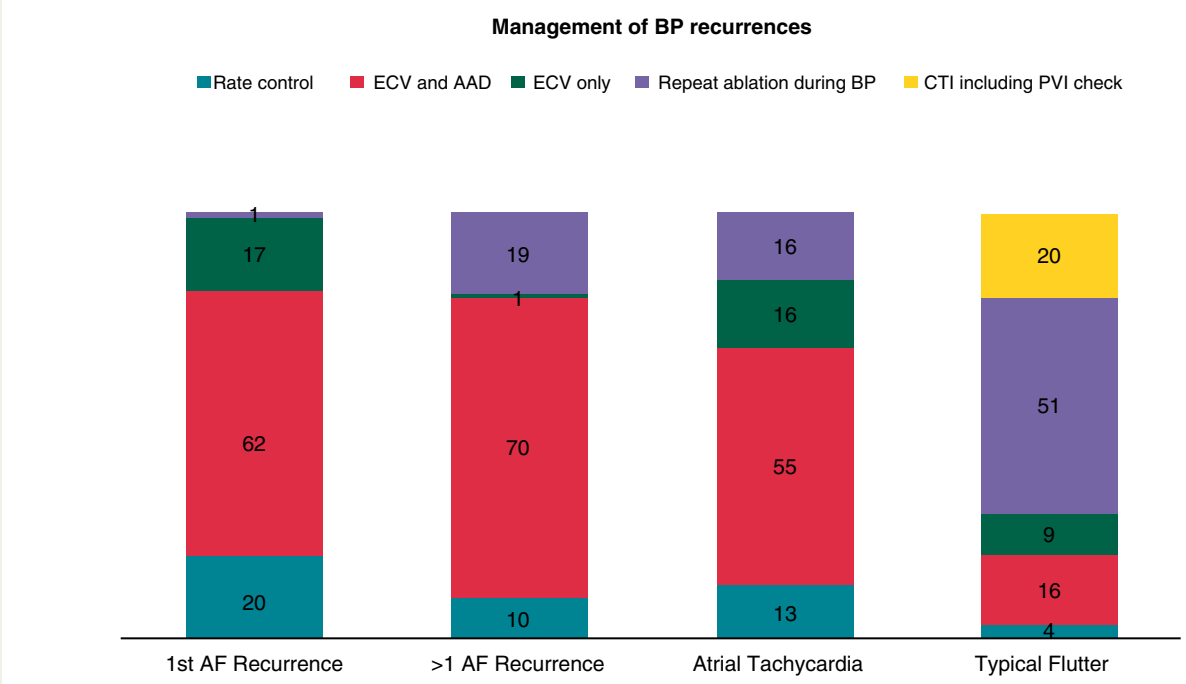

Figure 3 Preferred management of ERAT according to ERAT type and burden. AAD, antiarrhythmic drug; BP, blanking period, CTI, cavotricuspid isthmus; ECV, electrical cardioversion; ERAT, early recurrence of atrial tachyarrhythmias; PVI, pulmonary vein isolation.

ERAT [HV 50% (33–65) vs. non-HV 50% (30–60)]. These findings are summarized in Supplementary material online, *Material S2*.

Operators' perceptions on BP duration were similar between operators using the CB and those performing RFC ablation. Seventy-two percent of participants declared having experience in PVI with both CB and RFC, and almost half of these (47%) believe that both share the same rate of BP recurrences (with a third perceiving RFC as associating with more BP recurrences—Supplementary material online, *Material S3*). A strategy with ablation sets beyond PVI (PVI+) was indicated by a significant subset of operators (46%) in the case of persAF, but PVI+ operators and PVI-only operators indicated similar duration of BP, and similar perception on the rate of ERAT and rate of LR after ERAT (see Supplementary material online, *Material S4*).

Discussion

We present the results of the first physician-based survey focusing on the definition and rationale of BP after AF ablation and the management of ERATs during BP. The main findings of this survey are the following: (i) there is general adherence to the suggested 3-month BP despite a call for a shorter BP in patients with paroxysmal AF; (ii) the perceived rate of ERAT is 25%, being higher for patients with persAF compared with PAF; (iii) 50% of patients with ERATs are perceived to experience LR; (iv) electrical cardioversion and reintroduction of AAD are the preferred treatment for symptomatic ERAT during BP; (v) there is a lower threshold for repeat ablation during BP if the patient presents with a well-defined non-PV ablation target (such as atrial tachycardia or typical atrial flutter).

Rationale for blanking period, blanking period duration, and perceived rate of early recurrences of atrial tachyarrhythmia

A 3-month BP after AF ablation should be used according to the expert consensus statement when reporting AF ablation success at 1 year.[5,9] This suggestion is supported by the observation that not all ERATs are associated with late therapy failure.[10–12] However, new studies suggested that the distribution of ERAT in the first 3 months is not equally associated with late cure, particularly in the case of ERAT >4 weeks after the index procedure.[6] This association was confirmed by follow-up data from implantable loop recorders in the CIRCA DOSE trial,[7] where ERAT later than 52 days had a 95% specificity in predicting LRs.

Despite the new evidence, most electrophysiologists taking part in the current survey still indicated BP of 90 days, as proposed by the expert consensus on AF ablation, suggesting that a modification in this recommendation may be needed to change the current clinical practice. Interestingly, in the present survey we observed that some operators are inclined to consider a shorter BP in patients treated for PAF (at least 25% selected 60 days or less) compared with patients initially presenting with persAF. This data could be interpreted as a perception that late ERAT in PAF patients may be more predictive of PV reconnection and LR, as demonstrated by Das *et al.*[13]

In the present survey, the perceived overall median rate of ERAT is 25%, with a higher reported rate in persAF patients compared with PAF patients (30 vs. 20%). However, it has to be acknowledged that the majority of respondents only screen symptomatic patients, and

only 1% of operators declared to systematically use an implantable loop recorder to detect ERATs. Recently, continuous ECG monitoring revealed that ERATs can be recorded in the majority of patients after PVI[5]: in the CIRCA DOSE trial 211/346 (61%) of enrolled PAF patients had ERATs documented in the ILR.[7] The rate of *symptomatic* ERAT was 16% (55/346), a percentage that is not far to the 20% identified through this survey in PAF patients.

Clinical significance of early recurrences of atrial tachyarrhythmias and management

Almost all of the interviewed operators believe that ERAT are predictors of LR and that ~50% of patients with ERAT are expected to develop LR in the follow-up. The answers to these questions somehow reflect the message of multiple publications highlighting the not so benign nature of ERAT.[6,7,11,13]

The optimal management of ERAT is controversial.[5] Actually, 99% of the respondents declared to adopt a more conservative strategy for patients with a first recurrence during BP, mainly consisting of electrical cardioversion and reintroduction of AAD. According to the present survey, rate control strategies for ERAT are less preferred, in line with clinical data showing that in patients with ERAT cardioversion should be performed as early as possible.[14] Interestingly, more than half of the respondents keep AAD for the duration of BP, particularly Class I AAD: it has to be noticed that continued AAD beyond BP in patients free of AF has been shown to improve 1-year outcomes[15] but the value of AAD used only during BP is limited.[16–18]

Re-do ablations are performed by one-fifth of operators in patients experiencing multiple ERATs. Although ERAT, particularly those occurring beyond 3–4 weeks after ablation,[6,7] are predictors of LRs, the role of early re-do ablations remains debatable. Some studies suggested early re-do ablation could improve long-term results,[12,19] but with improved technologies and operator experience the rate of durable PVI has increased, raising the question of which ablation strategy and endpoint should be used when performing a re-do.

There are various possible explanations for ERAT and a multifactorial origin should be considered.[4] The theory of inflammation-induced pro-arrhythmia was the preferred one in this survey, but interestingly most do not see the role for anti-inflammatory drugs after a PVI procedure.

Sub-analysis of the present data showed that HV operators appear to report lower rates of ERAT in both PAF and persAF, but the perceived association between ERAT and LR remains similar for HV and nHV operators. A further sub-analysis could not clarify whether there is a difference in the perceived rate of ERAT according to the ablation technique used (CB or RFC). Published randomized studies on this topic are also contrasting, since data from CIRCA DOSE did not reveal any difference in ERAT burden between techniques, opposing what was observed in the Fire and Ice trial.[20] In this context, more real-world data are needed.

Limitations

This EHRA survey is limited by a potential selection bias. The survey was distributed via EHRA and different social media formats such as Twitter or Siilo in order to attract as many EP physicians as possible, but some EPs might not have been reached by the survey invitation. Country-specific regulations may impact catheter ablation and BP treatment strategies. Since responders could choose to skip specific questions, we report the percentage of given answers per each question. Of note, any survey is limited by recording perceptions and not prospective raw data. Still, given the large number of participants, this EHRA survey contributes to our understanding of knowledge gaps in the definition and management of ERAT.

Conclusions

In this EHRA survey, ERATs represent a common phenomenon after AF ablation which appear to predict LR. Participating electrophysiology physicians typically adhere to the 90-day BP, however, prefer in trend a shorter BP for paroxysmal AF patients. Early recurrences of atrial tachyarrhythmias are usually treated conservatively, but 20% of operators perform repeat ablation within BP in case of multiple ERATs or organized atrial arrhythmias. There is a need for randomized studies assessing the duration of BP and management of ERAT to fill in identified gaps in evidence.

Supplementary material

Supplementary material is available at *Europace* online.

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Data availability

The data underlying this article will be shared on reasonable request to the corresponding author.

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