

Contact-force guided radiofrequency vs. second-generation balloon cryotherapy for pulmonary vein isolation in patients with paroxysmal atrial fibrillation—a prospective evaluation

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Aims

In the setting of paroxysmal atrial fibrillation (AF), there are no available data comparing the mid-term outcome of patients undergoing pulmonary vein isolation (PVI) catheter ablation using contact-force (CF)-guided radiofrequency (RF) vs. second-generation balloon cryotherapy.

Methods and results

Prospective single-centre evaluation, carried out from March 2011 to February 2013, comparing CF radiofrequency (Thermocool[®] SmartTouch[™], Biosense Webster, Inc.) (CF group) with cryoballoon ablation (Arctic Front Advance[™] 28 mm cryoballoon, Medtronic, Inc.) (CB group), in regards to procedural safety and efficacy, as well as recurrence at 12 months. Overall, 150 consecutive patients were enrolled (75 in each group). The characteristics of patients of both the groups were similar (61.2 ± 9.9 years, women 25.3%, mean AF duration 4.1 ± 4.0 years, mean CHA₂DS₂-VASc score 1.4 ± 1.3, mean HAS-BLED 1.4 ± 0.6). Duration of the procedure was significantly lower in the CF group (110.7 ± 32.5 vs. 134.5 ± 48.3 min, $P = 0.001$), with a lower duration of fluoroscopy (21.5 ± 8.5 vs. 25.3 ± 9.9 min, $P = 0.017$) and X-ray exposure (4748 ± 2411 cGy cm² vs. 7734 ± 5361 cGy cm², $P = 0.001$). In contrast, no significant difference was found regarding significant procedural complication (2.7 vs. 1.3% in CF and CB groups, respectively; $P = 0.56$), and PVI was eventually achieved in all cases. At 12 months, AF recurrence occurred in 11 patients (14.7%) in the CB group and in 9 patients (12.0%) in the CF group (HR = 1.20 95% CI 0.50–2.90; log rank $P = 0.682$).

Conclusions

Our preliminary findings suggest that CF-guided radiofrequency and cryotherapy present very similar performances in the setting of paroxysmal AF catheter ablation.

Keywords

Atrial fibrillation • Contact-force • Cryoablation • Outcome • Catheter ablation

Introduction

Catheter ablation has been shown to be effective in treating patients with symptomatic paroxysmal atrial fibrillation (AF).¹ Pulmonary vein isolation (PVI) remains the corner stone of the strategy.² However, AF recurrences after a single procedure remain relatively frequent and in most of cases are related to PV reconnections.³ This may reflect the lack of effectiveness in achieving transmural, continuous and long-lasting lesions when performing PVI.^{4,5}

The contact force (CF) between catheter tip and target tissue has been shown to be a major influencing factor in providing effective tissue lesion.^{6–10} Accordingly, novel technologies for AF catheter ablation have recently focused on the optimization of the contact between both interfaces. On the one hand, two new radiofrequency catheters including the CF-sensing technology have been recently developed and commercialized allowing continuous CF monitoring during ablation.¹¹ On the other hand, second generation of cryoballoon (CB), the Arctic Front Advance[™], has been developed to

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What's new?

- Mid-term outcome of patients undergoing paroxysmal atrial fibrillation (AF) ablation with contact-force-guided radiofrequency
- Mid-term outcome of patients undergoing paroxysmal AF ablation with second-generation cryoballoon.
- Prospective comparison of the safety and efficacy of these two novel technologies.

optimize lesions in various settings of PV anatomies.^{12–14} The extent to which the CF technology may be potentially of additional value compared with cryotherapy (in terms of mid-term outcome) has not been evaluated so far.

In the present analysis, we prospectively compared the safety and efficacy (procedural and 12 months) of CF technology with second-generation CB in the setting of paroxysmal AF catheter ablation.

Methods

Setting and patient population

In this single-centre (Clinique Pasteur, France), non-randomized, prospective study, we compared procedural and 12-month outcomes of patients who underwent PVI in the setting of paroxysmal AF according to two different technologies: (i) radiofrequency ablation with the Thermocool[®] SmartTouch[™] (Biosense Webster, Inc.) catheter (CF group), from March 2011 to June 2012; (ii) Arctic Front Advance[™] 28 mm CB (Medtronic, Inc.) (CB group) from July 2012 to February 2013. Eligible patients were patients with paroxysmal AF refractory to at least one anti-arrhythmic drug from Class I or III undergoing a first PVI procedure. Exclusion criteria were in need of additional lines (i.e. roof, mitral isthmus) or ablation of complex-fractionated electrograms during the procedure. Of note, in our centre, the operators are dedicated exclusively to one of the techniques (two different operators for both CF and CB techniques) with a relatively high activity (> 100 AF ablation procedures/year/operator). Patient selection for one or the other group only depends on the electrophysiology physician they consulted before being referred for the procedure.

All patients provided an informed consent prior to the procedure. The study complied with the Declaration of Helsinki and the research protocol was approved by the local ethics committee.

Procedural details on ablation procedure

In all cases, computed tomographic scanning of the left atrium was performed 24 h prior to the procedure to assess PV anatomy and exclude the presence of left atrial thrombus. The procedure was performed under general anaesthesia like every AF ablation procedure in our centre. Using a transfemoral venous approach, a quadripolar catheter was placed in the coronary sinus. A single transseptal puncture was performed under fluoroscopic guidance. Transesophageal echocardiographic guidance was used only in case of failure of the usual fluoroscopic-guided approach. Upon completion of the transseptal puncture, patients received intravenous heparin to maintain an activated clotting time of 300–350 s. All patients underwent AF ablation were treated with interrupted vitamin-K antagonists and a peri-procedural bridging with subcutaneous heparin. Further details on the anticoagulation protocol have already been described.¹⁵ No oesophageal monitoring was done during the procedure.

Contact-force group

A circumferential mapping catheter (Lasso[™]; Biosense Webster[®]) was introduced into the left atrium using an 8.5 French long sheath. The Lasso catheter was used to collect left atrial geometry using the three-dimensional electroanatomic mapping system Carto 3[®]. After completion of left atrial geometry, the Lasso catheter was removed and an ablation catheter was introduced into the left atrium through the same transseptal sheath. Thermocool[®] SmartTouch[™] (Biosense Webster[®]) was introduced through the same transseptal sheath. Initial circumferential PV ablation was performed by systematic radiofrequency application around the PV ostia, consisting of an encirclement of ipsilateral pairs of PV antra (no >2 cm from the ostium on the posterior wall on both sides, and anterior aspect of right PVs, and guided by the ridge between the left PVs and the appendage) without additional adjunctive left atrial ablation. Power was limited to 30 W at anterior, superior, and inferior sites (flow rate, 17–20 mL/min) and 25 W at all posterior sites (flow rate, 17 mL/min), with temperature limited to 48°C for each lesion. Power was not adjusted according to CF. The novel CF-sensing catheter and viewing platform was used (Thermocool[®] SmartTouch[™], Biosense Webster[®]) to continuously assess catheter–tissue contact. Contact-force data were available to the operator throughout the procedure. The aim was to achieve a CF of at least 10 grams (mean) with a vector perpendicular to the tissue. The upper limit defined was 50 g force. These values were chosen based on animal studies, shown to be effective in lesion formation while avoiding perforation.^{7,9} Pulmonary vein isolation was first performed ‘anatomically’ (i.e. without the Lasso catheter, using an exclusive anatomic approach), the Lasso catheter being used only after completion of anatomic PVI to confirm full PV disconnection. This was done by testing both entrance and exit block (bidirectional block), with a waiting period of 20 min after the last radiofrequency application. In the event, complete disconnection was not achieved (failure of either exit or entrance block), the ablation catheter was reintroduced into the left atrium with the Lasso remaining in place using a double wire technique through the transseptal sheath. Thereafter, PVI was completed with Lasso guidance to eliminate all points of residual PV connection.

Cryoballoon group

A 14 French deflectable sheath (FlexCath[®] Medtronic[®]) was introduced into the left atrium after a single transseptal puncture. Then Arctic Front Advance[™] balloon was introduced in the sheath, inflated, and advanced to the ostium of each PV and ablation of pulmonary vein antra was performed with two applications of 240 s per vein. Occlusion of each vein was assessed either with venous angiography or with venous pressure curve at the discretion of the operator.¹⁶ Continuous monitoring of the phrenic nerve during ablation of the PVs was systematically performed by pacing the right phrenic nerve with a quadripolar catheter in the superior vena cava.

Pulmonary vein isolation was either assessed continuously using the circular Achieve[®] Catheter (Medtronic[®]) during CB freezing or traditionally using a circular catheter (Lasso[®], Biosense Webster[®]) after two applications. If the PV remained connected, additional applications were performed using different angulations. Pulmonary vein isolation was finally checked 20 min after the last CB ablation.

Standardized follow-up

After the index procedure, patients were followed for a total of 12 months. Patients were evaluated before hospital discharge, as well as at 1, 3, 6, 9, and 12 months after the procedure. A systematic transthoracic echocardiography and 24-h Holter monitoring were performed before discharge. Information collected during follow-up included a 12-lead electrocardiogram (ECG) and a 24-h Holter monitoring at each visit.

No antiarrhythmic medication was prescribed after catheter ablation, and the first 3 months post-procedure was considered as blanking period.² If there was documented recurrence of symptomatic AF during this time interval and the patient required antiarrhythmic drug therapy, a previously ineffective but tolerated Class I or Class III (sotalolol) drug was the preferred option. Anticoagulation strategy after the first 3 months was based on the CHA₂DS₂-Vasc and HAS-BLED scores.²

Procedural and 12-month endpoints

Procedural endpoint was PV isolation confirmed by entry and exit block after a waiting time of 20 min. The specific differences of the two used therapeutic approaches are described above. The following procedural safety and efficacy endpoints were assessed, using the criteria proposed by Sorgente et al.,¹⁷ especially the primary procedural efficacy endpoint proportion of effective PVI. Regarding the mid-term follow-up, the endpoint was defined by the rate of AF recurrence, defined as any symptomatic or asymptomatic atrial arrhythmia lasting >30 s after the blanking period during the year after catheter ablation. This was actively ascertained by Holter monitoring at 1, 3, 6, 9, and 12 months or by 12-lead ECG in the case of symptomatic palpitation at clinical interview, in the absence of antiarrhythmic therapy. Patients with recurrence of AF during the blanking period with no response to cardioversion (either pharmacological or direct-current) were classified as having a relapse (only one case in the CB group).

Statistical analysis

Comparisons were performed between the two treatment groups. χ^2 was used for nominal variables and Student's *t*-test was used for comparison of continuous variables, where appropriate; Levene's test was used to check the homogeneity of variance; equivalent non-parametric tests were used when Kolmogorov–Smirnov was in favour of absence of normal distribution. Results with $P < 0.05$ were regarded as significant. Variables that differed at baseline between the two treatment groups and their impact on sinus rhythm maintenance were assessed using Cox regression (using the forward stepwise method likelihood ratio; probability for stepwise = 0.05). Cox regression was also performed for assessing the predictors of relapse. Kaplan–Meier curves were traced for comparing sinus rhythm maintenance among the two treatment strategies and the log-rank test was used for assessing existing differences. Our hypothesis was that no differences would be observed among the two therapeutic approaches as regards AF relapse. An effect size of 0.2 was estimated using contingency tables assuming two equal samples and a 25% relapse rate, equal in H_0 and with a 50% increase in one of the treatment groups as the alternative hypothesis. Thus, the computed achieved power (β) of the sample assuming the effect size of 0.2, nominal α of 0.05, and a sample size of 150 was estimated to be 0.7. PASW Statistics version 18.0 was used for descriptive and inferential statistical analysis.

Results

Patient characteristics

Population characteristics are detailed in Table 1. The mean age of patients was 61.2 ± 9.9 years. The proportion of women was 25.3%; mean AF duration was 4.1 ± 4.0 years. Mean CHADS₂ score was 0.8 ± 0.9 , CHA₂DS₂-VAsc score 1.4 ± 1.3 , and HAS-BLED 1.4 ± 0.6 without significant differences between the two groups. Overall, no significant baseline differences were observed between the CF and CB groups, except for body mass index (28.3 ± 4.6 for

CB group vs. 26.5 ± 3.9 for CF group, $P = 0.011$) and creatinine clearance assessed through the modification of diet in renal disease (81.8 ± 22.5 mL/min in the CB group vs. 73.2 ± 14.9 mL/min in the RF group, $P = 0.001$).

Procedural results

Procedural data are detailed in Table 2. Duration of the procedure was significantly lower in the CF group with 110.7 ± 32.5 min vs. 134.5 ± 48.3 min in the CB group ($P = 0.001$) (Table 2). Consequently, duration of fluoroscopy and X-ray dosage were also significantly lower in the CF group (21.5 ± 8.5 vs. 25.3 ± 9.9 min; $P = 0.017$ and 4748 ± 2411 cGy cm² vs. 7734 ± 5361 cGy cm², $P = 0.001$) (Figures 1 and 2).

In both groups, all PVs were disconnected at the end of the procedure. No complementary RF applications were needed to achieve complete PVI in the CB group. Mean CF observed in the CF group was 19.7 g+/-38.

No peri-procedural deaths or thromboembolic events were observed. Major bleeding occurred in two patients in the CF group (groin haematoma and upper gastrointestinal bleeding with the need of red-blood cell transfusion) and in one patient in the CB group (pseudaneurysm requiring fibrin injection) (Table 3). Transient phrenic nerve palsy occurred in 13 (17.3%) patients in the CB group, with normal diaphragmatic function at the end of the procedure.

Twelve-month follow-up

At 12-month follow-up, AF recurrence occurred in 11 patients (14.7%) in the CB group and in 9 patients (12.0%) in the CF group (Univariate Cox Regression HR = 1.20 95% CI 0.50–2.90; $P = 0.681$; from Kaplan–Meier curves, log rank $P = 0.988$) (Figure 3). All recurrences were symptomatic and confirmed by a ≥ 30 s ECG or Holter tracing. A redo procedure was performed until March 2014 in eight patients in the CF group, and in two in the CB group. Although two patients in the CF group did not present any PV reconnection, the average number of reconnected veins was similar in patients treated with CF or CB: 1.6 ± 1.3 vs. 1.5 ± 0.7 ; $P = 0.902$, respectively.

On Cox regression, assessing all variables that on univariate analysis presented $P < 0.1$ regarding the existence of AF relapse (AF duration in years, heart failure, hypertension, previous stroke or transient ischaemic attack, CHADS₂, CHA₂DS₂-VAsc, and HAS-BLED), only AF duration (HR per year = 1.14; CI 95% 1.03–1.26; $P = 0.014$), heart failure (HR = 6.42; CI 95% 2.05–20.16; $P = 0.001$) and previous stroke or transient ischaemic attack (HR = 5.85; CI 95% 1.81–18.92; $P = 0.003$) were independent predictors of AF relapse (see Supplementary material online).

Discussion

Our data suggest that paroxysmal AF patients who underwent ablation using either the novel Artic Front AdvanceTM CB or the SmartTouchTM CF catheter present similar propensity of remaining free from AF recurrence at 12 months out of any anti-arrhythmic drugs. At the best of our knowledge, this is the first evaluation of these two newly available technologies for AF catheter ablation.

Pulmonary vein isolation is known to be particularly challenging due to the relative difficulty in maintaining a good contact with the

Table 1 Baseline characteristics of patients

	Overall (n = 150)	CF group (n = 75)	CB group (n = 75)	P
Age, years	61.2 ± 9.9	62.5 ± 8.9	59.9 ± 10.6	0.111
Female gender	25.3% (38)	24.0% (18)	26.7% (20)	0.707
BMI	27.4 ± 4.3	26.5 ± 3.9	28.2 ± 4.6	0.015
AF duration, years	4.1 ± 4.0	4.4 ± 4.1	3.8 ± 4.0	0.321
HF	4.7% (7)	2.7% (2)	6.7% (5)	0.246
HTN	41.3% (62)	48.0% (36)	34.7% (26)	0.097
DM	6.0% (9)	4.0% (3)	8.0% (6)	0.302
Stroke/TIA	7.3% (11)	10.7% (8)	4.0% (3)	0.117
Vascular disease	10.0% (15)	9.3% (7)	10.7% (8)	0.785
CHADS ₂	0.8 ± 0.9	0.9 ± 0.9	0.7 ± 0.9	0.162
CHA ₂ DS ₂ -VASc	1.4 ± 1.3	1.5 ± 1.3	1.3 ± 1.3	0.308
HAS-BLED	1.4 ± 0.6	1.5 ± 0.6	1.4 ± 0.5	0.243
Sleep apnoea	8.7% (13)	5.3% (4)	12.0% (9)	0.147
Indexed LAV, cm ³	41.4 ± 13.4	39.5 ± 11.3	42.8 ± 15.2	0.127
LVEF, %	65.0 ± 6.5	65.5 ± 5.6	64.4 ± 7.4	0.323
Haemoglobin, g/dL	14.8 ± 1.3	14.8 ± 1.2	14.8 ± 1.4	0.954
Clearance MDRD, mL/min	77.5 ± 19.5	73.2 ± 14.9	81.8 ± 22.5	0.006
CRP, mg/L	5.0 ± 14.8	5.8 ± 19.8	4.2 ± 6.6	0.511

BMI, body mass index; HF, heart failure; HTN, hypertension; DM, diabetes mellitus; TIA, transient ischaemic attack; LAV, left atrial volume; LVEF, left ventricle ejection fraction; CRP, C-reactive protein.

Table 2 Procedural data

	Overall (n = 150)	CF group (n = 75)	CB group (n = 75)	P
Presence of left common trunk, %	18% (27)	24 (15%)	16 (12%)	0.505
Duration of procedure, min	122.0 ± 42.3	110.7 ± 32.5	134.5 ± 48.3	0.001
Duration of fluoroscopy, min	23.4 ± 9.4	21.5 ± 8.5	25.3 ± 9.9	0.017
X-Ray dosage, cGy cm ²	6123 ± 4296	4748 ± 2411	7734 ± 5361	0.001
Procedural data—cryo patients N = 75		Procedural data—CF patients N = 75		
Utilization of the achieve	54.7% (41)	RF duration, s		1954 ± 805
Total number of applications	8.5 ± 1.0	Average impedance, Ohm		145 ± 14
Time of cryoenergy, s	1933 ± 175	Average power, W		22.9 ± 2.1
Average minimum temperature, °C	-52.9 ± 5.0	Average CF, g		19.7 ± 38

tissue all over the encirclement, leading CF technology particularly welcome in this setting. Also, achieving optimal CF since the first application is of particular importance, in order to limit tissue oedema formation. Recent studies have reported that using a CF-sensing catheter leads to overall success and reduces procedural time, and X-ray exposure.^{18–20} As we began AF ablation with the CF-sensing catheter in March 2011, very few studies determining a cut-off value had been published, except in the animals. We determined this minimal value of 10 g with the goal to be safe and effective, according to our preliminary experience. The recently published EFFICAS I study has suggested that a minimum CF of 20 g per application appears to be an interesting cut-off to improve mid-term clinical outcomes,²¹ that is this target value was enhanced to 20 g, in line

with the average CF measured in our patients (19.7 g).²² Regarding CB ablation, it has recently been reported that the new generation CB improves the efficiency of the procedure reducing the time to PV isolation, procedural time, and overall success compared with the first-generation balloons.^{23–25} Our findings provide additional data showing that CB ablation in paroxysmal AF ablation is a relatively safe and effective technique. Phrenic nerve palsy has been described as the most frequent complication, although the vast majority of them revert shortly. We observed longer procedural and fluoroscopy times in the CB group compared with the CF group; of note, we performed two systematic 240 s applications on each PV in the CB group, whereas recent studies suggest that application time could be probably reduced without interacting with the efficacy of

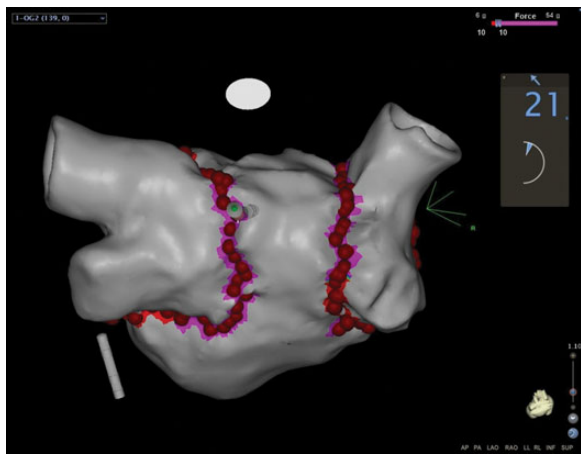


Figure 1 Catheter ablation using the CF technology (Thermocool® SmartTouch™, Biosense Webster, Inc.). The objective was to have the ablation catheter oriented the most perpendicular to the wall with a force of at least 10 grams. Here the posterior part of the left PVI.

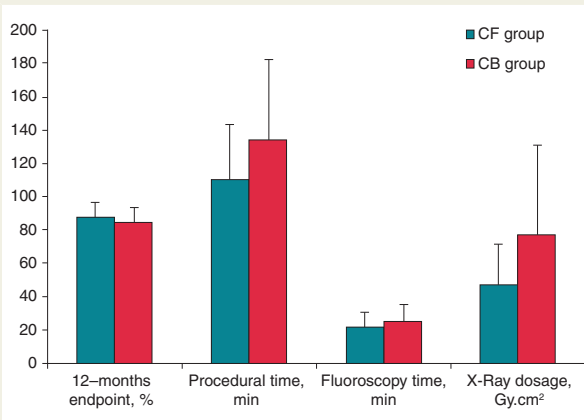


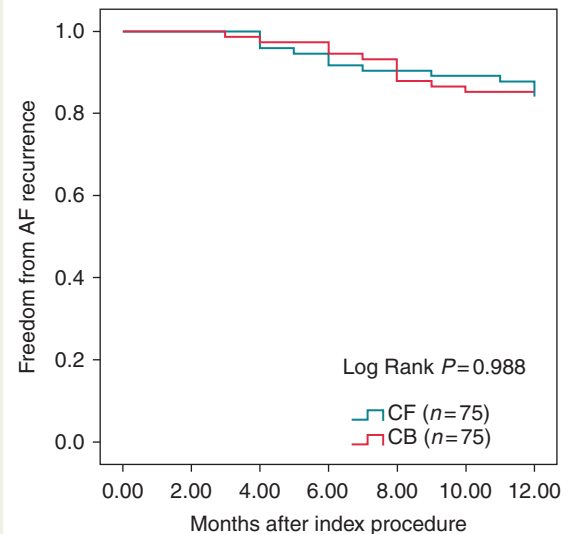
Figure 2 Twelve-month endpoint and procedural data.

PVI.^{26–28} The short time with CF should be interpreted with some caution. Because our centre has got a strong expertise in the technique, and the time with radiofrequency use is more likely to be influenced by level of operator's experience (in contrast with a more 'standardised' time using CB), differences in times between the two techniques could be less significant in less experienced centres. Indeed, CB ablation is usually shorter and more reproducible than radiofrequency ablation in the setting of paroxysmal AF ablation.^{29,30}

Although preliminary experiences comparing cryotherapy with radiofrequency (non-CF) ablation (in terms of acute procedural outcome) are available, to the best of our knowledge, we provide here the first evaluation using mid-term outcomes. The recent results from the German Ablation Registry have suggested that (first-generation) CB ablation and (non-CF) radiofrequency ablation presented a similar efficacy in terms of acute success, in the setting of paroxysmal AF

Table 3 Procedural outcome

	Overall (n = 150)	CF group (n = 75)	CB group (n = 75)	P
Major bleeding	2.0% (3)	2.7% (2)	1.3% (1)	0.560
Thromboembolic events	0% (0)	0% (0)	0% (0)	NA
Peri-procedural deaths	0% (0)	0% (0)	0% (0)	NA
Relapse post-blanking	13.3% (20)	12.0% (9)	14.7% (11)	0.608



	3 months	6 months	9 months	12 months
CF	75	69	67	66
CB	74	71	63	62

Figure 3 Kaplan–Meier survival curve—proportion of patients free of AF during the 12-month follow-up (3-month blanking period).

ablation.³¹ Another recent study has been carried out in a large population of 396 patients from 2008 to 2011.²⁹ The results have shown that the two techniques presented similar peri-procedural efficacy and safety. The investigators have observed a lower proportion of phrenic nerve injury than more recently found with the Arctic Front Advance™.³² In contrast with our results, the investigators of the randomized COR trial have found that CB ablation was inferior to irrigated radiofrequency (non-CF) catheters.³³ However, of note, in our study, all PVs were disconnected at the end of the procedure, especially in the CB group, whereas in the COR trial, only 83% of PVs remained disconnected in the CB group. This may be potentially the result of the two systematic 300 s applications, without any additional application in the case of residual veno-atrial conduction. Secondly, in the COR trial, only the first-generation CB was used, which, as previously mentioned, seems to be less effective.

We acknowledge several limitations. First, this is not a randomized trial and inclusion of the patients for one or the other group is subject to bias, despite the similarity of baseline variables that was observed. Secondly, regarding the CB group, PV occlusion verification was checked differently: one operator used pressure-guide while the other used contrast injection. Thirdly, this is a single centre study, from a centre performing more than 500 AF ablation procedures per year. The extent to which these results may apply to less experienced centres needs further investigation. Fourthly, systematic monitoring using an implantable loop recorder might have documented higher rate of asymptomatic recurrence. However, the relative proportion of patients with exclusively asymptomatic AF is not expected to be systematically different between the two groups, and finally the likelihood that this bias was differentially low.

Conclusion

Our findings suggest that CF real-time assessment using a SmartTouch™ catheter and CB ablation using the novel Arctic Front Advance™ display a very similar procedural efficacy and safety. More importantly, our results also suggest that the mid-term effectiveness profile as regards the 12-month recurrence rate (almost 85% of patients remaining free of AF without anti-arrhythmic drugs) is highly similar between both the groups. Further randomized and multicentric evaluations are needed to confirm these preliminary results in order to finally identify specific subgroups more likely to benefit from one or the other technique.

Supplementary material

Supplementary material is available at *Europace* online.

Conflict of interest: S.B. has received fees as a consultant for Medtronic and Boston Scientific. J.P. Albenque is a consultant for Biosense Webster and St. Jude Medical. Other authors: No conflict of interest.

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Tako-tsubo cardiomyopathy following catheter ablation of atrial fibrillation

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Tako-tsubo cardiomyopathy is characterized by reversible left ventricular dysfunction following emotional or surgical stress. Unlike the well-known complications of catheter ablation (CA) of atrial fibrillation (AF), Tako-tsubo cardiomyopathy has been rarely reported so far. We report a case of acute reversible left heart failure following successful CA of paroxysmal AF in a patient with a history of panic disorder.

A 58-year-old female with symptomatic AF episodes despite medical therapy was admitted for CA. Her medical history was consistent with hypertension and panic disorder. She had normal left ventricular (LV) function and slightly enlarged left atrium. Biochemical tests, electrocardiogram (ECG), chest X-ray, and computed tomography (CT) scan were normal. Coronary angiography revealed normal coronary arteries. Catheter ablation procedure was performed by isolating pulmonary veins successfully without any complications. During the hospital stay, she developed progressive dyspnoea. Electrocardiogram showed sinus tachycardia and new-onset T wave inversion in precordial leads. Echocardiography excluded pericardial effusion but showed dyskinesia of the apex with normal basal segments with left ventricular ejection fraction of 35%. Computed tomography scan excluded pulmonary embolism and pulmonary vein (PV) stenosis. Left ventriculography demonstrated typical apical ballooning consistent with Tako-tsubo syndrome. Following conservative therapy for heart failure, she had a complete recovery and was discharged 3 days later with normal LV function.

In this case, acute onset reversible left ventricular dysfunction following AF ablation was due to Tako-tsubo cardiomyopathy. It is possible that the increased emotional stress as well as the damage of the autonomic plexi located in the PV antrum during CA may have triggered this situation.

The full-length version of this report can be viewed at: [http://www.escardio.org/communities/EHRA/publications/ep-case-reports/Documents/tako-tsubo cardiomyopathy.pdf](http://www.escardio.org/communities/EHRA/publications/ep-case-reports/Documents/tako-tsubo%20cardiomyopathy.pdf).

