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ORIGINAL ARTICLE

Ablation Index-guided high-power, short duration ablation shortens the procedure and ablation times with similar outcomes in long-term follow-up

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Abstract

Background: The single procedure success rate of durable pulmonary vein isolation (PVI) for paroxysmal atrial fibrillation (PAF) varies between 85 and 90 %. This prospective, randomized study investigated the efficacy of high-power, short duration (HPSD) ablation in a power-controlled mode versus standard power settings in terms of single-procedure arrhythmia-free survival, safety outcome and procedural times during a long-term follow-up of 31 months.

Methods and Results: A total number of 176 patients undergoing de-novo catheter ablation for PAF were randomized into two different treatment arms. In group A, PVI was performed using radiofrequency ablation (RFA) with standard power settings (30W) in a power-controlled mode. The ablation procedure in group B was also performed with RFA but with higher power settings (45W). To achieve complete pulmonary vein isolation, we used the ablation index (AI) and an interlesion distance of ≤ 6 mm with a surround flow catheter (Thermocool STSF, Biosense Webster, USA)). 88 patients were randomized into each group without significant differences in baseline characteristics. During a mean follow-up of 31.42 ± 7.83 months after a single procedure, 63 (72%) patients in group A were free of arrhythmia recurrences versus 68 (77%) patients in group B (p=0.09). The procedure time was significantly shorter in group B (group A: 115.35 ± 15.38 min vs group B: 96.45 ± 17.19 min; p<0.01). Fluoroscopy time and dose area product were also significantly lower in group B (group A: 9.66 ± 3.86 min vs group B: 5.45 ± 2.35 min; 330.84 ± 150.36 cGy/cm2 vs 202.51 ± 135.23 cGy/cm2; p<0.01). The total ablation time and the ablation time per patient was significantly shorter in group B (2736 min. vs. 1660 min. p <0.05; 36.48 min. vs. 21.01 min. p <0.05). The incidence of steam pops, either audible or visible by spike potentials was significantly higher in the high power group. In each group there were two patients with a significant, post-interventional inguinal hematoma which needed surgical repair. However, no pericardial effusions or neurological complications were seen.

Conclusion: This study concludes that RF-ablation using high-power settings (45W) in combination with ablation index and an interlesion distance of 6 mm is safe, leads to shorter procedure times, a lower total ablation time and shows no significant difference in arrhythmia free survival after 31 months as compared to a 30W setting. Caution is necessary in regard of esophageal heating and the higher incidence of steam pops. More studies are required to analyze the benefit and the drawbacks of intermediate power ablation.

Keywords: atrial fibrillation; catheter ablation; high-power short duration

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Introduction

Pulmonary vein isolation (PVI) has become the cornerstone for the interventional treatment of paroxysmal atrial fibrillation (PAF). Durable PVI is necessary to prevent arrhythmia recurrence. Despite intensive research during the past 15 years in the field of catheter ablation for PAF, recurrence rates after PVI remain as high as 10-20% after a single procedure even in highly experienced centers.[1-3] The main reason is a recovery of initially isolated pulmonary veins (PVs). Thus, to overcome these limitations efforts have been focusing on techniques which enhance the durability of PV isolation. The recent introduction of contact force catheters,

ablation index and the interlesion distance to encircle the PVs improved the contiguity of the lesions and lesion size and therefore enhanced the outcome after PVI.[4-6]

High-power ablation leads to a more resistive heating creating larger dispersal lesions with reduced depth.[7] Therefore, it could reduce the interlesion gaps improving long-term outcomes. Moreover, a shorter lesion depth decreases the collateral damage of surrounding tissue such as the esophagus and surrounding nerves.[8] Using higher power, the procedure and ablation times are shorter with a comparable long-term effect on durable PVI.[9,10] There are reasonable concerns regarding the safety in terms of steam pops and pericardial tamponade as well as esophageal fistula[11] which need further investigation.

The aim of the present study was to compare high-power ablation with 45 Watts versus standard power settings with 30 Watts, using Ablation index and an interlesion distance of 6 mm regarding single-procedure arrhythmia-free survival, safety and procedural times.

Methods

Study population

This prospective, randomized analysis enrolled a total of 176 patients with symptomatic PAF. All patients were referred for the interventional treatment of PAF according to the current guidelines. A detailed diagnostic work-up was performed in our outpatient department prior to admission. All antiarrhythmic drugs, except for amiodarone, were discontinued at least five half-lives prior to the procedure. The study was approved by the institutional review board and ethics committee, performed according to the declaration of Helsinki and all patients provided written informed consent.

Study protocol

Paroxysmal AF was defined according to the current guidelines12. All patients presented with self-terminating episodes with at least one documented episode of atrial fibrillation in a Holter-ECG-recording.

Ablation procedure

The procedure was performed under continuous propofol sedation and fractionated fentanyl if necessary. Directly before the procedure left atrial thrombi were excluded by transesophageal echocardiography. Through the right femoral vein, access to the left atrium was achieved with a single transseptal puncture. A single heparin bolus of 5,000 IU was administered before transseptal puncture and afterwards an additional bolus of 5,000-10,000 IU of heparin was given according to the patient´s body weight and prior anticoagulation. The activated clotting time was assessed every 30 minutes and maintained within a range of 250-350 seconds. A temperature probe (S-CATH M, Circa Scientific, Englewood, CO, USA) was positioned in the esophagus and the endoluminal temperature was monitored throughout the procedure with a temperature alarm set at 39°C.

The following catheters were introduced via the right femoral vein: (1) a steerable decapolar catheter (Biosense Webster, Diamond Bar, CA, USA) which was positioned in the coronary sinus; (2) a circumferential decapolar diagnostic catheter (Lasso NAV 15 or 20 mm, Biosense-Webster, Diamond Bar, CA, USA) to map the pulmonary vein ostia; (3) a 3.5 mm externally irrigated-tip, surround flow ablation catheter with contact force (CF) measurement (Thermocool STSF, Biosense-Webster, Diamond Bar, CA, USA). For anatomical guidance, a 3-dimensional reconstruction of the left atrium and the PVs was created using the Carto 3 system (Biosense Webster, Diamond Bar, CA, USA). PVI was performed by point-by-point RF delivery using the ablation index and with an interlesion distance 6 mm to achieve a contiguous circle enclosing the ipsilateral veins6. Real-time automated display of RF applications (VISITAGTM, Carto 3, Biosense Webster) was used with predefined settings for catheter stability (3 mm for 8 sec) and minimum contact force (CF, 30% of time > 4 g). RF application was continued until an ablation index (AI) of 380 at the posterior wall and 480 at the anterior wall was reached. AI values were determined by a personalized approach for the workflow of the operator recommended and performed by Biosense Webster taking into account an interlesion distance of less than 6 mm and a tag size of 3 mm. The RF ablations were segmented into 5 segments (anterior, roof, ridge, inferior and posterior). Out of the values of contact force, ablation time and energy level the AI was calculated. In the

Table 1. Clinical characteristics of the study population according to treatment arm

	Group A (30W) n= 88	**Group B (45W) n= 88**	**p-value**
Age, mean ± SD	65.5 ± 8.8	64.6 ± 11.7	0.57
Male, n (%)	47 (53%)	51 (58%)	0.64
BMI, mean ± SD	27.6 ± 4.1	27.5 ± 4.3	0.97
AHT, n (%)	68 (77%)	66 (75%)	0.45
LV-EF, mean ± SD	55.7 ± 4.5	56.4 ± 5.4	0.42
Left atrial diameter (cm)	3.9 ± 0.2	4.1 ± 0.3	0.54
Valv HD, n (%)	3 (3%)	5 (6%)	0.77
CHD, n (%)	6 (7%)	10 (11%)	0.88
Stroke, n (%)	5 (6%)	7 (8%)	0.87
CHA_2DS_2-Vasc-Score, mean ± SD	1.8 ± 1.6	2.1 ± 1.7	0.17
ECV prior ablation, n (%)	6 (7%)	5 (6%)	0.77
NOAC, n (%)	79 (90%)	81 (92%)	0.84
Vitamin K antagonist, n (%)	3 (3%)	4 (4%)	0.71
AADs, n (%)	24 (27%)	27 (31%)	0.76
Class I agent, n (%)	19 (22%)	24 (27%)	0.88
Class III agent, n (%)	5 (6%)	3 (3%)	0.69

SD = standard deviation; AHT = arterial hypertension; LV-EF = left ventricular ejection fraction, valv HD = valvular heart disease; CHD = coronary heart disease; ECV = electrical cardioversion; NOAC = novel oral anticoagulant; AAD = antiarrhythmic drug treatment

Table 2. Procedural Data

	Group A (30 W)	**Group B (45 W)**	**p-value**
Procedural time (min)	115.35 ± 15.38	96.45 ± 17.19	<0.05
Fluorography time (min)	9.66 ± 3.86	5.45 ± 2.35	<0.05
Dose area prod. (cGy/cm^2)	330.84 ± 150.36	202.51 ± 135.23	<0.05
Duration/Patient (min)	36.48 ± 4.56	21.01 ± 3.23	<0.05

Data are presented as mean ± SD
SD = standard deviation

absence of a complete isolation after the completion of the ipsilateral circle, additional RF applications were delivered upon the discretion of the operator.

PVI was confirmed by entrance- and exit-block of the PVs using a circular mapping catheter. RF was delivered in a power-controlled mode without ramping with 30W or 45W (irrigation flow: 8 ml/ min) with the SmartAblate generator and pump (Biosense Webster, Diamond Bar, CA, USA).

If the esophageal temperature rose above 39°C, ablation at the posterior wall was stopped immediately. To achieve a complete isolation the circle or the energy level was lowered to avoid esophageal temperature rise. A complete encircling of the ipsilateral veins and the completion of AI was still attempted. After the PVI an observation period of 20 min guaranteed detection of early PVs recovery. Early reconnection was treated with touch-up ablation until PVI was reached.

In group A, a standard power setting (30W) was used, whereas in group B the ablation power was set at 45W as the use of the ablation index tool was approved up to 45W. The ablation index and the interlesion distance were similar in both groups.

Follow-up

All patients were on oral anticoagulation (OAC) after the ablation procedure for at least three months. After this period, the OAC was either stopped or continued according to the CHA2DS2-VASc-Score of the patient.

A follow-up after 12, 24 and 30 months was performed. All patients received 48 hours Holter-ECGs every 3 months. A detailed history of the patient´s symptoms suggestive for potential arrhythmia recurrences was taken. In case of undocumented symptoms and suspicion for arrhythmia recurrences, documentation with additional external ECG event recordings was performed. A documented symptomatic or asymptomatic atrial fibrillation episode lasting > 30 seconds was defined as recurrence. A PAF-recurrence and a persistent atrial fibrillation (persAF)-recurrence was defined according to the current guideline[12]. An initial blanking period of 3 months was observed. Any recurrence after the blanking period were considered a procedural failure.

The antiarrhythmic drug treatment was stopped after ablation. If the patientsexperienced an early recurrence during the blanking period, antiarrhythmic drugs were re-administered for the remaining time of the blanking period. However, all antiarrhythmic drugs were discontinued at the end of the blanking period.

The primary endpoint was atrial fibrillation-free survival after the blanking period and during a follow-up of 31 months. Secondary endpoints were procedural complications and PV recovery during redo procedures.

Statistical analysis

Sample size was calculated (80% powered) for anticipated decrease in PVI duration of 15 minutes as shown in previous and related studies. To observe a difference with a power of 0.90 and an alpha-level of 0.05, inclusion of at least 88 patients in each group was calculated. The power calculation was performed with the G*Power 3.1 program (University of Duesseldorf). The patients were randomized 1:1 to the high power or standard treatment arm at enrollment to assure a uniform and blinded distribution. A research electronic data capture toll was used for a computerized central block randomization design to generate and stratify randomization according to study site. The random assignment was performed before the procedure.

Data distribution was assessed according to the Kolmogorov–Smirnov test. Continuous variables were compared using an unpaired Student’s t-test or a Mann–Whitney U test as appropriate. Data were expressed as mean ± standard deviation or as median and range. Categorical data were evaluated using the Chi-square test or Fisher’s exact test as appropriate.

Kaplan-Meier cumulative event rates were calculated, with event or censoring times measured from the time of ablation. For patients who did not complete the study and who did not have an event, the time-to-event measure was stopped at the last contact.

All tests were two-sided, and a p-value of < 0.05 was considered statistically significant.
Statistical analysis was performed with SPSS 27.0 (IBM, Armonk, New York, USA).

Results

A total of 176 consecutive patients undergoing de-novo catheter ablation for paroxysmal AF were enrolled in the study. Patient characteristics were

well-balanced and are displayed in Table 1. The described electrical cardioversions were performed prior ablation within 48 hours after the onset of AF. Left atrial diameter was measured in all patients and showed no significant differences (group A (30W): 3.9 ± 0.2 cm vs. group B (45W): 4.1 ± 0.3 cm; p= 0.54). In both groups some patients were on antiarrhythmic drug treatment prior to the procedure (group A: Class Ic: 15, Dronedarone: 4, Amiodarone: 5; group B: Class Ic: 19; Dronedarone: 5, Amiodarone: 3, Table 1).

Procedural results

PVI was achieved in all patients. The mean procedure time was significantly shorter in group B (45W) as compared to group A (30W): 96.45 ± 17.19 min vs 115.35 ± 15.38 min, p<0.05. Mean fluoroscopy time and dose area product were also significantly shorter and lower in group B (45W): 5.45 ± 2.35 min vs. 9.66 ± 3.86 min; 202.51 ± 135.23 cGy/cm^2 vs 330.84 ± 150.36 cGy/cm^2, p<0.05 (Table 2).

Total ablation time was shorter and total energy application was lower in Group B (1660.08 min; ablation time/pat.: 21.01 min vs. group A: 2736.3 min; ablation time/pat.: 36.48 min; p< 0.05).

In group A (30W) the first pass isolation was achieved in 79 (90 %) patients for the left circles and in 83 (94%) for the right circles, whereas in group B it was achieved in 82 (93%) patients for the left circles and in 84 (95%) for the right circles. To achieve PVI, 11 touch-up ablations for the left circles and 8 touch-up ablations for the right circles in group A were needed, whereas in group B 6 touch-up ablations for the left circles and 4 for the right circles were required (Figure 2). Ablation time and further procedural data are reported in Table 3 and Table 4.

During the observation period an early PV recovery occurred in 11 (12%) patients for the left circles and in 2 (2%) patients for the right circles in group A and in 4 (4%) patients for the left circles and in 1 (1%) patient for the right circles in group B. The standard power setting showed a trend towards a higher incidence of early recovery as compared to the high-power setting (Table 4).

Esophageal heating occurred in both groups (Table 4). The high-power group showed a trend towards a higher incidence of esophageal heating during the ablation of the left circles (Table 4). The esophageal heating occurred within 1-4 sec after the onset of ablation with a very rapid temperature rise. Endoscopic evaluation of esophageal lesions was not routinely performed. None of the patients showed symptoms of esophageal injury. Subclinical esophageal lesions most likely were missed.

Audible and visible steam pops occurred significantly more often in the high-power group (6 (7 %) vs 22 (25%) in group B; p<0.05, Table 4), but none led to a pericardial tamponade or neurological symptoms. Cranial MRI was not routinely performed to detect microemboli.

Primary Endpoint: 31-months-follow-up

All patients completed the per protocol endpoint of a 30-months follow-up. After the blanking period, 10 (11%) patients in the standard setting group and 10 patients (11%) in the high-power group experienced a PAF recurrence (p = 1). PersAF recurrence was observed in 12 patients in group A and in 7 patients in group B (p = 0.78). Atrial tachycardia was observed in 3 patients in each group. The outcome according to ablation power is summarized in Table 4. The Kaplan-Meier 1-year arrhythmia-free survival estimation after a single procedure revealed no significant differences between the groups after a mean follow-up of 31 ± 8 months (Figure 1). Single-procedure freedom from any recurrences after one year follow-up was 86% in group A and 90% in group B. After a long-term follow-up the freedom from any arrhythmia was 72 % in group A (30W) and 77 % in group B (45W).

Secondary endpoint: Electrophysiological findings during repeat procedures and complications

A total of 28 patients underwent repeat ablation (group A: 15 (17%), group B: 13 (15%)). The rate of PV recovery, displayed as PV recovery per PV, during repeat procedures showed no significant differences in both groups (group A: 8 (9%) versus group B: 5 (6%); p=0.42) and remained low (Table 4).

In both groups, a re-isolation of the pulmonary veins was performed if PV recovery was seen. If the PVs were still isolated at the time of the repeat-procedure a substrate modification with electrogram-guided ablation in combination with line deployment was performed to terminate AF. The PV recovery sites at redo procedures are displayed in Figure 2.

Table 3. Ablation Data

	Group A (30 W)	Group B (45 W)	p-value
Total ablation time (min)	2736.3 ± 115.63	1660.08 ± 99.89	<0.05
Ablation time/Patient (min)	36.48 ± 4.65	21.01 ± 3.45	<0.05
Total Energy (J)	4767643 ± 1584.50	4287863 ± 1786.65	<0.05
Total average power (W)	4839384 ± 2644.32	3515062 ± 2236.87	<0.05
Average power (W)	28.75 ± 2.10	42.71 ± 5.37	<0.05
Max power (W)	30.43 ± 2.10	45.53 ± 5.33	<0.05
Max. Impedance (Ohm)	167.32 ± 17.77	167.77 ± 17.46	0.23
Average Impedance (Ohm)	154.38 ± 16.23	156.35 ±15.99	0.34
Average contact force (gr)	14.01 ± 3.48	11.45 ± 2.56	0.44

The data are presented as mean ± SD or n (%)
SD = standard deviation

Table 4. Ablation data according to ablation power in the left and right pulmonary veins

	Group A (30 W) Left circles	Group B (45 W) Left circles	p-value
RF ablation time (min), mean ± SD	21 ± 6	14 ± 6	0.19
RF tags (mean ± SD)	28.6 ± 6.4	26.3 ± 4.7	0.62
Ablation index achieved (%)	92	94	0.75
First pass isolation, n (%)	79 (89%)	82 (93%)	0.42
Touch-up applications, n	11	6	0.20
Ave power, Watts	28.9 ± 2.4	42.6 ± 2.2	< 0.05
Perimeter, mm	32 ± 6	31 ± 5	0.63
Esophageal heating, n (%)	15 (17%)	25 (28%)	0.07
Recurrence during waiting period, n (%)	11 (12%)	4 (4%)	0.06
Audible steam pops, n (%)	6 (7%)	22 (25%)	< 0.05
	Right circles	**Right circles**	**p-value**
RF ablation time, min	18 ± 5	12 ± 7	0.23
RF tags (mean ± SD)	28.7 ± 5.4	28 ± 5.3	0.62
Ablation index achieved (%)	96	98	0.72
First pass isolation, n (%) Touch-up applications, n	83 (94%) 8	84 (95%) 4	0.86 0.23
Ave power, Watts	26.6 ± 4.2	43.5 ± 2.7	< 0.05
Perimeter, mm	34 ± 4	33 ± 6	0.34
Esophageal heating, n (%)	15 (17%)	14 (16%)	0.46
Recurrence during waiting period, n (%)	2 (2. %)	1 (1%)	0.56
Audible steam pops, n (%)	6 (7 %)	10 (11%)	0.29

RF = radiofrequency, SD = standard deviation

No pericardial effusions, thromboembolic events or atrio-esophageal fistula occurred. Two patients in each group suffered from significant groin hematoma requiring surgical repair. The mean length of hospital stay was 24 8 hours.

Discussion

Main findings

The presented study has the following main findings: 1) The arrhythmia-free survival is similar in high-power and conventional power settings at a long-term follow-up of 30 months, 2) High-power ablation leads to shorter procedure and ablation times, 3) High-power ablation leads to a rapid rise in esophageal temperature if ablation is performed close to the esophagus. 4) The occurrence of steam pops is significantly higher in the high-power group. 5) AF-recurrence emerges earlier in time in the high-power group.

Strategies to achieve durable PV isolation

The pulmonary vein potentials are the most important cause of PAF, and electrical PV isolation is the cornerstone of AF ablation procedures.[13] Arrhythmia recurrences after ablation are mainly attributed to electrical PV reconnection with a strong correlation between the clinical magnitude of arrhythmia recurrences and the number of atrial-to-vein conduction recovery of the PVs.[14] Thus, significant efforts were made to develop techniques and tools that may help to enhance a durable PVs isolation after a single procedure. In this attempt, several strategies were investigated, such as elimination of dormant conduction induced by adenosine, the implementation of a waiting period after PVI, the contact force-guided ablation (TOCCATA),[15] and the implementation of an AI following the CLOSE protocol6. The latter significantly decreased the duration of PVI compared to the previous ablation strategies.[6]

Table 5. Outcome according to ablation power

	Group A (30W) n= 88	**Group B (45W) n= 88**	**p-value**
Recurrence at 3 months, n (%)	14 (16%)	6 (7%)	0.04
Recurrence at 12 months, n (%)	12 (14%)	9 (10%)	0.89
Recurrence at 30 months, n (%)	25 (28%)	20 (23%)	0.44
PAF as recurrence, n (%)	10 (11%)	10 (11%)	1
PersAF as recurrence, n (%)	12 (14%)	7 (8%)	0.78
AT as recurrence, n (%)	3 (3%)	3 (3%)	1
Redos, n (%)	15 (17%)	13 (15%)	0.99
PV recovery, n (%)	8 (9%)	5 (6%)	0.42
Extended Afib ablation, n (%)	7 (8%)	8 (9%)	0.56

PAF = paroxysmal atrial fibrillation; PersAF = persistent atrial fibrillation; PV = pulmonary vein

The latter significantly decreased the duration of PVI compared to the previous ablation strategies.[6] In this study we showed that a catheter ablation consisting of contact force–guided pulmonary vein isolation targeting an interlesion distance of ≤6 mm and an operator-specific ablation index had a high successful rate with a single-procedure freedom from any recurrences of ~ 90% at one year, irrespective of which power setting was used. Unlike the CLOSE protocol the Thermocool surround flow catheter was used in this study, which is applying the energy in a power-controlled mode with a more extensive cooling system. Thus, the heating of the superficial tissue is reduced and the energy is more likely to be transmural.

The high-power, short duration ablation is a new strategy to achieve efficient results and reduce collateral damage.[16] Previous studies showed that

high-power, short duration ablation is safe and reduced the total procedure time with an equally efficacy regarding a durable PVI.[17,18] The SHORT-AF trial, comparing RFA with 50W versus 25-30W showed shorter procedure times, greater freedom of AF recurrence and a trend towards a higher number of asymptomatic cerebral amboli.[19] Our study confirms the previous results with a shorter procedural, fluoroscopy and ablation time using a 45W setting as compared to the standard setting. However, we observed in ~ 30% of patients a rapid rise of the esophageal temperature within 1-3 seconds after the onset of ablation of left PVs with high power.Compared to the standard setting, the high-power group showed a trend towards a higher incidence of esophageal heating during the ablation of the left circles, which occurred mainly during the ablation of the posterior wall. Thus, the posterior wall ablation of the left veins should be performed carefully with an esophageal temperature probe to overcome the possible complication of a fistula. In the Power-AF study (45W vs 35W), in 44 patients an endoscopic evaluation was performed and showed one esophageal lesion in both groups. The lesion in the high-power group corresponded an esophageal perforation with the need of implantation of a covered stent. Those findings emphasize the need of an esophageal temperature probe and the

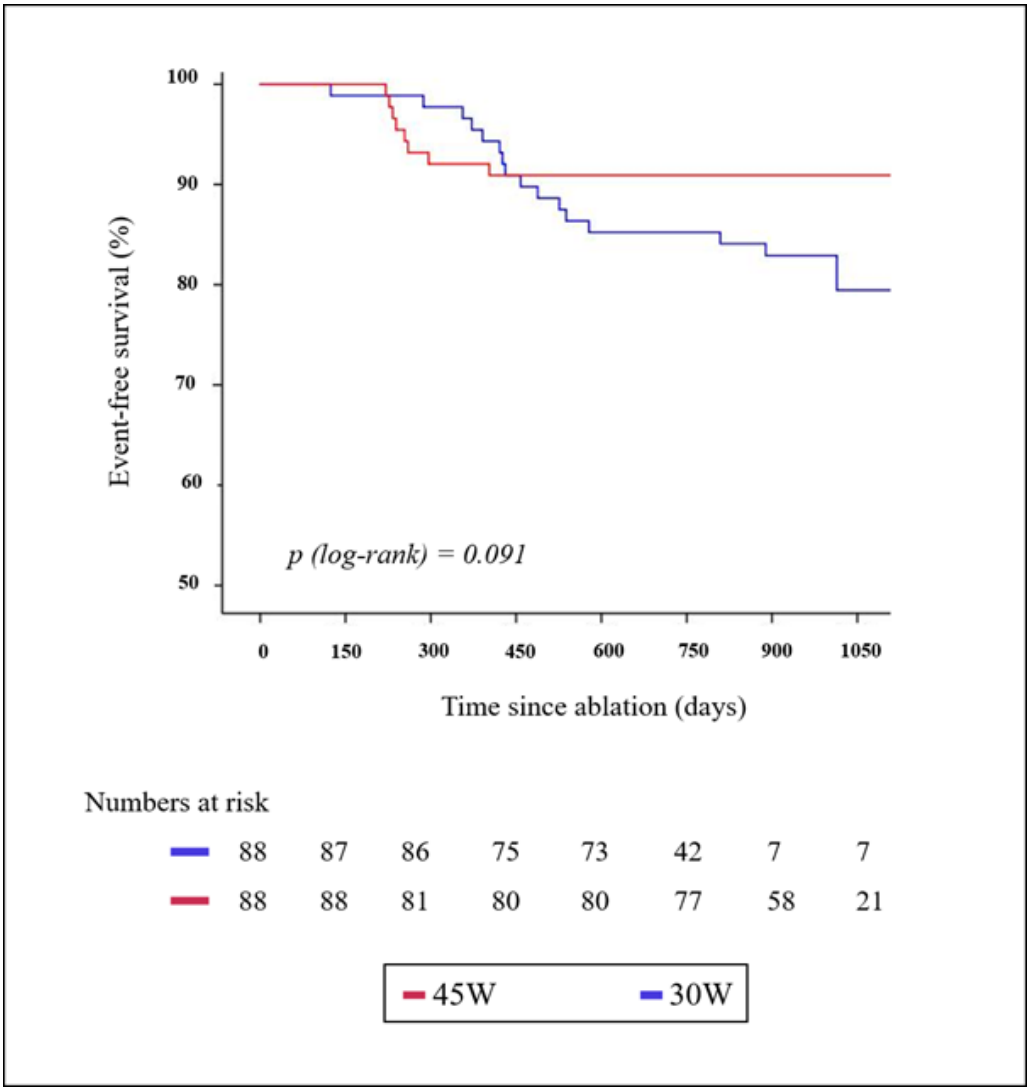
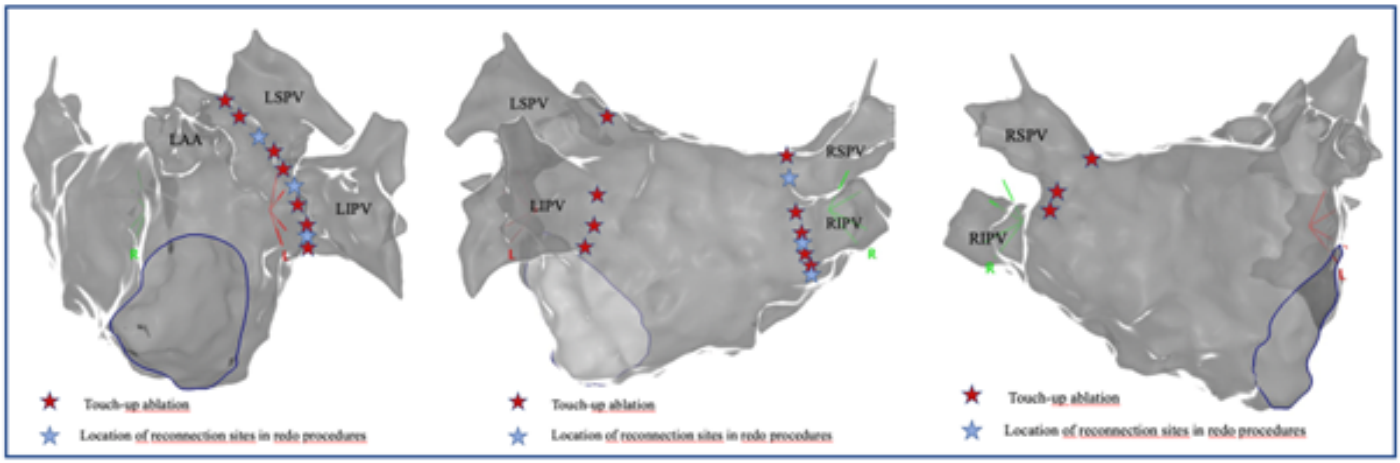
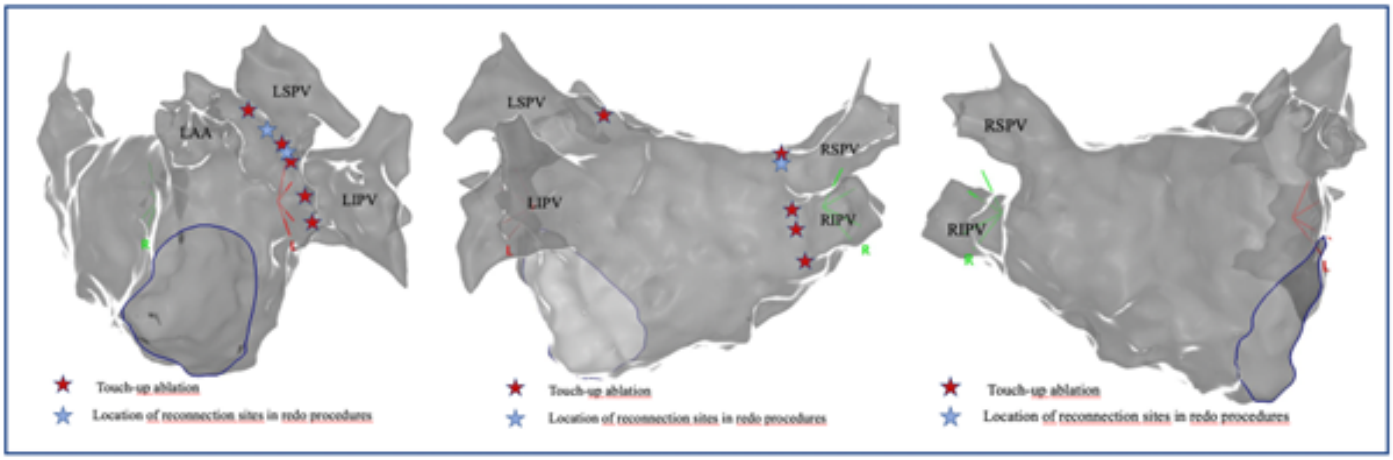


Figure 1. Kaplan-Meier arrhythmia-free survival estimation during an overall mean follow-up of 31.42 ± 7.83 months after a single procedure. No significant differences in regard of the outcome were observed.



Group A (30 W)



Group B (45 W)

Figure 2. Touch-up ablation and reconnection sites.

need of caution when ablating the posterior wall.[20] The use of 90W to perform PVI is supposed to lead to wider and more shallow RF lesions. Therefore, the incidence of esophageal ulcers should be lower. The POWER PLUS Trial (90W vs 35/50W) demonstrated a higher incidence of esophageal heating in the conventional group an one steam pop in the very high-power group without any visible complications.[21] It needs to be further investigated whether higher power RFA, that leads to a more resistive heating and therefore to more shallow lesions, definitely leads to a lower number of esophageal heating and esophageal lesions.

In addition, in our study significantly more audible or visible (by spike potentials in the ablation catheter during ablation) steam pops occurred in the high-power group as compared to the standard setting; however, we did not observe concomitant complications such as pericardial tamponade or obvious cerebral emboli. The rather high number of steam pops in our study may be due to more vigilance regarding audible or visible steam pops. Although, none of the steam pops resulted in overt complications, some studies reported a higher incidence of silent cerebral emboli when using very high power.[22] Therefore, more data about the safety of very high-power ablation is important to definitely prove the benefit besides the shorter procedure times.

Using the same AI values in combination with a higher power setting has been reported to lead to comparable long-term results regarding PVI durability. Most studies followed the CLOSE protocol with an interlesion distance of less than 6 mm and AI values of 550 anterior and 400 posterior.[23,24]

In this study we used lower AI values (480 at the anterior wall and 380 at the posterior wall) but an interlesion distance of less than 6 mm and we observed a first pass isolation in most of our patients in both group (> 90%). Our results are comparable to previous published data. In contrast to already in existence studies we performed a long-term follow-up over more than 2 years with more emphasize of the esophageal heating and the occurrence of stem pops.

During the follow-up of 30 months the recurrence rate in the high-power group emerged earlier in time (within in the first 6 months) and stayed more stable thereafter. Whereas, the 30W group showed a continuous occurrence of atrial arrhythmia. Regarding the redo procedures, in five patients of the high-power group the PVs were reconnected as compared to eight patients in the group A. The overall reconnection rate of PVs was low in both groups over the long-term follow-up. Most of the redo-procedures were performed due to persistent atrial fibrillation with isolated veins. Whether an increased interlesion distance leads to comparable results needs to be further investigated. Overall, the recurrence rate of PV reconnection is low in both groups and most of the atrial arrhythmias were persistent AF or atrial tachycardia with still isolated PVs in redo procedures.

Limitations

The monocentric nature of the study limits its generalizability. Furthermore, no endoscopy was performed routinely to search for esophageal injury as esophageal heating occurred more often in the high-power group. Finally, no cranial MRI was performed in order to analyze the impact of the relatively high number of steam pops, regarding silent cerebral emboli. The ablation index was less than in the CLOSE protocol due to a personalized approach provided by Biosense Webster to the operator.

Conclusions

This study concludes that RF-ablation using high-power settings (45W) in combination with ablation index and an interlesion distance of 6 mm is safe, leads to shorter procedure times, a lower total ablation time and shows no significant difference in arrhythmia free survival after 31 months as compared to a 30W setting. Caution is necessary in regard of esophageal heating and the higher incidence of steam pops. More studies are required to analyze the benefit and the drawbacks of intermediate power ablation.

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Conflict of Interests

None

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