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The systemic inflammatory response syndrome post two different kinds of atrial fibrillation approaches ablation

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The pulmonary veins (PV) have been identified as the source of triggers initiating paroxysmal atrial fibrillation (AF) [1]. Contemporary catheter ablation techniques either use the electrical isolation of the limited segmental ablation at the PV ostia (venous-atrial junction) [2,3] or extensive burning approaches with the circumferential isolation of atrial tissue in the adjacent left atrium (LA) [4-6] sometimes supplemented by linear lesions between defined anatomical structures to interrupt macro reentrant circuits [7,8]. Identifying the impact of additional LA tissue ablation in modifying the maintaining substrate in the physiopathology AF process of persistent and permanent AF, even more, extensive ablation procedures have been supported, aiming LA strategic zones branded by complex fractionated potentials [9,10]. These extensive and extremely complex ablation designs are related with rare but overwhelming complications, as atrium-esophageal fistula [11,12] or vagal nerve damage, provoking acute pyloric spasm and gastric hypomotility [13], consequential from extra cardiac penetration of ablative power. A post cardiac injury syndrome has been reported, both following linear radiofrequency ablation in the LA for AF [14], as well as after catheter ablation for treat other arrhythmias [15], featuring a systemic inflammatory response syndrome (SIRS). This study was conducted at the Hospital e Clínica São Gonçalo, Rio de Janeiro, Brazil, where patients were recruited from the Artificial Cardiac Pacing Department. The study was approved by the Hospital e Clínica São Gonçalo Ethics Committee and was conducted in accordance with the principles of the Declaration of Helsinki. All patients signed written informed consent prior to study inclusion. The results are expressed as a mean and standard deviation for normally distributed data and as median with interquartile range otherwise. All statistical tests were two-sided. Comparisons between two-paired values were performed with the paired t-test in cases of a Gaussian distribution or by the Wilcoxon test otherwise. Comparisons between more than two-paired values were made by repeated-measures analysis of variance or by Kruskal–Wallis analysis of variance as appropriate, complemented by a post-hoc test. Categorical variables were compared with Fisher's exact test. A P-value <0.05 was considered significant. Correlations between two variables were performed by Pearson's chi-square test in case of a Gaussian distribution and with the Spearman correlation test otherwise. All statistical analyses were performed using the program Graphpad Prism v 7.0 (Graphpad Software, La Jolla, CA, USA).

We reported in this study 469 cases of AF ablation, performed from 2010 to 2016, being 397 cases of PV isolation only, and 72 extensive ablation procedures to treat more complex cases of AF. The general features of these patients are displayed in Table 1. From the total number of procedures, 18 cases developed SIRS, 3 (1%) patients after PV isolation only and 15 (21%) subjects after extensive AF ablation, as shown in Figure 1. Comparing both groups, the relative risk to develop SIRS after the procedure is 5.242 higher in the extensive ablation group, with 95% Confidence Interval (CI) ranging from 2.225 until 14.980, and P<0.0001. The patients' features during SIRS treatment post the ablation procedure in both groups are demonstrated in Table 2. The correlation between the PV isolation only and the number of ablated spots is weak: r=0.1888, 95%CI=0.092 to 0.282 and P=0.0002. However, the correlation between the extensive ablation and the number of ablated spots is stronger than the first one: r=0.7232, 95%CI=0.591 to 0.818 and P<0.0001. The Receiver Operating Characteristic (ROC) curve from the number of ablated spots presented an area under the ROC curve: 0.9726, 95%CI: 0.9221 – 0.9986, P<0.0001, sensitivity: 94%,

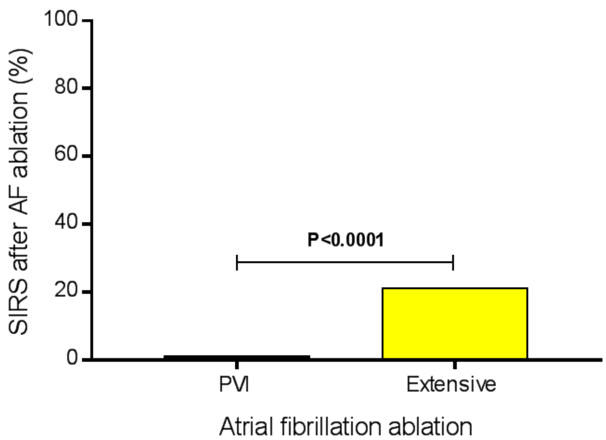

Figure 1. From the total number of procedures, 18 individuals developed SIRS, being 3 (1%) patients after PVI only and 15 (21%) subjects after extensive AF ablation, P<0.0001; AF, atrial fibrillation; PVI, pulmonary vein isolation; SIRS, systemic inflammatory response syndrome.

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Table 1. Patients' baseline characteristics.

Parameters	PVI	Extensive ablation	P value
N	397	72	---
Age, years	58.3 ± 13.9	61.6 ± 17.0	0.0745
Body mass index, kg/m²	28.0 ± 3.6	28.6 ± 4.1	0.2038
Male gender (%)	253 (64%)	40 (56%)	0.1891
White ethnicity (%)	297 (75%)	50 (69%)	0.3810
Hypertension (%)	300 (76%)	60 (83%)	0.1736
Hyperlipidemia (%)	272 (69%)	56 (78%)	0.1259
Type 2 Diabetes Mellitus (%)	150 (38%)	20 (28%)	0.1115
Coronary artery disease (%)	90 (23%)	12 (17%)	0.2813
Atrial fibrillation	397 (100%)	72 (100%)	1.0000
Creatinine, mg/dL	0.90 ± 0.15	0.93 ± 0.17	0.1270
eGFR, mL/min/1.73 m²	94.3 ± 12.5	91.6 ± 13.7	0.0974
Albumin/creatinine ratio, mg/g	12.5 ± 10.6	11.7 ± 8.5	0.5449
Antihypertensive			
ACE-inhibitors/ARB (%)	260 (65%)	51 (71%)	0.4181
β blockers (%)	290 (73%)	51 (71%)	0.7738
Diuretics (%)	250 (63%)	48 (67%)	0.5962
DHP calcium channel blockers (%)	177 (45%)	36 (50%)	0.4408
Mean 24-hour ABPM, mmHg	139 ± 11/94 ± 4	141 ± 12/95 ± 6	0.1358/0.1306
Echocardiographic parameters			
Indexed LA volume (mL/m²)	28.6 ± 3.5	41.4 ± 6.0	<0.0001
IST (mm)	9.1 ± 1.8	9.4 ± 1.5	0.1834
LVPWT (mm)	10.6 ± 1.9	11.0 ± 2.3	0.1129
LVEF, Simpson (%)	62.5 ± 8.5	61.9 ± 8.1	0.5792
LEVDD (mm)	50.8 ± 4.6	51.7 ± 5.3	0.1367
LEVSD (mm)	32.5 ± 5.5	33.4 ± 7.7	0.2333
LV mass index (g/m²)	167.4 ± 17.2	170.9 ± 23.0	0.1340

Data are presented as mean ± standard deviation or n (%). ABPM, ambulatory blood pressure measurements; ACE, angiotensin-converting enzyme; ARB, angiotensin receptor blocker; DHP, dihydropyridine; eGFR, estimated glomerular filtration rate; IST, interventricular septum thickness; LA, left atrium; LV, left ventricular; LVEDD, left ventricular end-diastolic diameter; LVEF, left ventricular ejection fraction; LVESD, left ventricular end-systolic diameter; LVPWT, left ventricular posterior wall thickness. N, number of patients; PVI, pulmonary vein isolation.

specificity: 99%, cutoff point of ablated spots to occur the SIRS episode after the procedure: >191 points.

In conclusion, patients submitted to an extensive radio frequency ablation to treat AF are at higher risk than subjects underwent PV isolation only, for a possibly SIRS development post procedure. With supportive therapy, including mechanic ventilation, corticosteroids and diuretics administration this serious complication seems to be treatable, with resolution of the syndrome surrounded by 15 days.

Table 2. Patients' features during SIRS treatment post the ablation procedure.

Parameters	PVI	Extensive ablation	P value
N	3	15	---
Clinical parameters			
Dyspnea	3 (100%)	15 (100%)	1.0000
Temperature, °C	38.6 ± 0. 8	39.5 ± 0.9	0.1370
Symptom onset, hours	28.0 ± 18.3	18.4 ± 6.2	0.1000
Pulmonary congestion	3 (100%)	15 (100%)	1.0000
Need for mechanical ventilation	0 (0%)	11 (73%)	0.0429
Corticosteroids onset	3 (100%)	15 (100%)	1.0000
Diuretic onset	3 (100%)	15 (100%)	1.0000
Complete recovery, days	9.5 ± 2.8	10.7 ± 4.0	0.5592
Laboratory tests			
Leukocytes, per µL	17,797 ± 4,551	22,659 ± 5,902	0.1999
C-reactive protein, mg/dL	31.7 ± 9.3	33.8 ± 8.4	0.7042
Negative blood cultures	3 (100%)	15 (100%)	1.0000
Negative urine cultures	3 (100%)	15 (100%)	1.0000
Creatinine, mg/dL	1.53 ± 0.25	1.97 ± 0.41	0.0985
Chest tomography			
Bilateral edema	3 (100%)	15 (100%)	1.0000
Pleural effusion	0 (0%)	11 (73%)	0.0429
Electrocardiogram			
Sinus rhythm	3 (100%)	15 (100%)	1.0000
Echocardiogram			
LVEF by Simpson's method, %	57.0 ± 2.6	55.1 ± 4.7	0.5185
Presence of pericardial effusion	0 (0%)	0 (0%)	1.0000
Left atrium angiotomography			
Presence of pulmonary vein stenosis	0 (0%)	0 (0%)	1.0000
Ablation procedure			
Mean number of ablated spots	196.0 ± 4.6	228.9 ± 50.0	0.2831
Total procedure time, min	256.7 ± 40.4	243.3 ± 42.4	0.6236
Total fluoroscopy time, min	72.0 ± 7.2	60.7 ± 17.1	0.2876
3D electro-anatomical mapping system use	3 (100%)	15 (100%)	1.0000
Radio frequency power, W	36.7 ± 2.9	37.3 ± 4.6	0.8136
Catheter irrigation, mL	1,900 ± 100	2,123 ± 243	0.1443

Values are presented as mean ± SD or %. LVEF, left ventricular ejection fraction; SIRS, systemic inflammatory response syndrome.

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