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ORIGINAL RESEARCH

Catheter Ablation of Atrial Fibrillation in Patients With Psoriasis: A Multicenter Study

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BACKGROUND: Psoriasis is linked to an increased risk of atrial fibrillation (AF). However, data on the electrophysiological substrate and outcomes of AF ablation in patients with psoriasis are lacking.

METHODS: We conducted a retrospective, multicenter study involving 48 patients with psoriasis (median age, 66 years [56–72]; 79% male) and paroxysmal (n=25.52%) or persistent AF (n=23.48%) who underwent ablation at 4 high-volume institutions between 2018 and 2023. Propensity score-matching identified 96 controls without psoriasis undergoing AF ablation at the same institutions. The primary end point was survival free from atrial tachyarrhythmia recurrence after an 8-week blanking period.

RESULTS: Baseline clinical characteristics were well balanced between groups. However, patients with psoriasis had higher CRP (C-reactive protein) than controls (0.85 mg/dL [0.45–1.2] versus 0.3 mg/dL [0.3–0.4], $P<0.001$) and a greater burden of left atrial low-voltage regions at electroanatomical mapping (20% [11%–20%] versus 5% [5%–10%]; $P=0.013$). Over a median follow-up of 20 (13–32) months, atrial tachyarrhythmia recurrence occurred in a higher proportion of patients with psoriasis (40% versus 24%, log-rank $P=0.023$). Patients with psoriasis also had a slightly higher risk of acute coronary syndrome (log-rank $P=0.045$), with similar risks of death (log-rank $P=0.517$) and procedural complications (2% versus 2%, $P=1.000$), whereas no stroke occurred. Multivariable analysis identified early recurrence within blanking period (adjusted hazard ratio [aHR], 5.9, $P<0.001$), preablation CRP levels (aHR, 1.2, $P=0.016$), and psoriasis history (aHR, 2.2, $P=0.046$) as predictors of atrial tachyarrhythmia recurrence. In the group with psoriasis, the optimal CRP cutoff associated with atrial tachyarrhythmia recurrence was found to be 1 mg/dL.

CONCLUSIONS: Psoriasis is associated with low-grade systemic inflammation, more severe electroanatomical markers of atrial cardiomyopathy, and worse postablation outcomes. The association between CRP levels and rhythm outcomes suggests that inflammation may drive recurrences among patients with psoriasis undergoing AF ablation.

Key Words: atrial cardiomyopathy ■ atrial fibrillation ■ catheter ablation ■ inflammation ■ psoriasis ■ radiofrequency energy

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CLINICAL PERSPECTIVE

What Is New?

- In this multicenter study, patients with psoriasis and atrial fibrillation undergoing catheter ablation had higher preprocedural CRP (C-reactive protein) levels, larger left atrial low-voltage regions, and a greater risk of atrial tachyarrhythmia recurrence and acute coronary syndrome during follow-up compared with propensity score-matched control patients without psoriasis.
- Multivariable analysis identified a history of psoriasis, early recurrence during blanking period, and preprocedural CRP (C-reactive protein) levels as predictors of atrial tachyarrhythmia recurrence.

What Are the Clinical Implications?

- These findings suggest that systemic inflammation may be an important mechanistic determinant of adverse rhythm outcomes among patients with psoriasis undergoing atrial fibrillation ablation; future studies should identify optimal pre- and postprocedural anti-inflammatory strategies and evaluate novel ablation energy sources to reduce the risk of atrial tachyarrhythmia recurrence in this patient population.

Nonstandard Abbreviations and Acronyms

AT	atrial tachyarrhythmia
PV	pulmonary vein
PVI	pulmonary vein isolation

Atrial fibrillation (AF) is the most common sustained arrhythmia worldwide, with an overall prevalence of 2%–4%, and it is expected to increase in the forthcoming years due to extended longevity in the general population.[1]

In addition to age, genetic predisposition, and cardiovascular risk factors, inflammation may play a relevant role in the development of AF through several mechanisms.[2,3] Chronic autoimmune diseases such psoriasis have been shown to increase risk of AF because proinflammatory cytokines such as TNF-α (tumor necrosis factor-α), IL-6 (interleukin-6), and IL-17 may determine a chronic inflammatory milieu favoring atrial arrhythmogenesis.[4,5] Accordingly, recent studies have shown the possible role of inflammation and oxidative stress in AF development, especially in recurrent forms.[6] Additionally, psoriasis is associated with ischemic stroke, which is the most dreaded complication of AF.[5]

Despite the well-described link between AF and psoriasis, to the best of our knowledge, there is a paucity of evidence concerning rhythm control strategies, and data on catheter ablation in this patient group are completely lacking. This is clinically relevant because catheter ablation, as part of a rhythm control strategy, has been increasingly used in recent years.[7]

The aim of this study was to determine the procedural findings and long-term clinical outcomes after catheter ablation therapy in a multicenter cohort of patients with AF and psoriasis.

METHODS

This was an observational, retrospective, multicenter study involving 4 high-volume electrophysiology centers in Europe and the United States (Marche University Hospital, Ancona, Italy; Antwerp University Hospital, Antwerp, Belgium; IRCCS Galeazzi Sant'Ambrogio Hospital, Milan, Italy; and Texas Cardiac Arrhythmia Institute, Austin, TX), enrolling all patients with psoriasis and AF who underwent a first catheter ablation between February 2018 and June 2023. For each patient with psoriasis, 2 propensity score-matched patients with AF without psoriasis, who received ablation at the same institutions and during the same period, were also enrolled. The contributions of individual participating centers are detailed in Table S1.

Clinical data, imaging and laboratory tests, procedure details, medical therapies, and follow-up information were collected for each participant in a central database. The study was performed according to institutional standards, national legal requirements, and the Declaration of Helsinki; patient data were collected in an institutional review board-approved database. All patients provided written informed consent for the invasive procedure, and the data that support the findings of this study are available from the corresponding author upon reasonable request. The results of the study are reported following the Strengthening the Reporting of Observational Studies in Epidemiology cohort reporting guidelines.[8]

Study Groups and Propensity Score Matching

Two groups of patients with AF undergoing a first catheter ablation at participating institutions were identified: patients with psoriasis and control patients without psoriasis. The diagnosis of psoriasis was made by dermatologists based on the typical appearance of skin lesions,[9] and details concerning the disease were collected in each patient by reviewing medical records.[9] At each center, patients with psoriasis were matched to patients without psoriasis according to propensity scores with a 1:2 ratio, to control for confounding due to imbalance of covariates between groups.

Procedural Settings

Procedures were carried out according to institutional standards at participating centers by experienced operators using radiofrequency energy. The use of preprocedural transesophageal echocardiography to rule out intracardiac thrombus was according to expert consensus recommendations.[10] Ultrasound-guided access to the right femoral vein was obtained, followed by a single transseptal puncture using an 8.5Fr SL0 fixed sheath and a Brockenrough needle. All procedures were carried out under esophageal temperature monitoring using a dedicated thermal probe.

The ablation (SmartTouch SurroundFlow, Biosense Webster, CA; QDOT Micro, Biosense Webster, CA; Tacticath, Abbott, IL; Tactiflex, Abbott, IL) and multielectrode mapping catheters (Lasso, Biosense Webster, CA; PentaRay, Biosense Webster, CA; HD Grid, Abbott) were advanced into the left atrium (LA).[10] Electroanatomical reconstructions of the LA were obtained with the CARTO or EnSite electroanatomical mapping systems, and pulmonary vein (PV) isolation (PVI) was performed by deploying point-by-point radiofrequency energy applications in the PV antra and intervenous carina.[10] The energy settings were either standard-power (30–40 Watt), targeting ablation index values of 400 in posterior segments, and 500 to 550 in anterior regions using SmartTouch SurroundFlow (or lesion size index values of 4 and 5.3 in posterior and anterior segments, respectively, using Tacticath),[11,12] or high-power short-duration, with 50 Watt-10 s radiofrequency energy pulses using Tactiflex,[13] or very-high power, short duration, with 90 Watt-4 s applications in posterior regions and temperature-controlled 50 Watt pulses (QMODE) targeting ablation index values of 500 to 550 in anterior segments of the PVs using QDOT Micro.[11,14] radiofrequency energy delivery began with the catheter in a stable position, and a contact force ≥5 g.[10] Persistent bidirectional PVI was demonstrated at the end of the ablation procedure via remapping PV antra using a multielectrode catheter (PV entrance block), and by pacing with 10 mA@2 ms pulses from within the PV antra (PV exit block). The ablation of LA structures outside PVs (LA posterior wall, LA appendage, coronary sinus [CS], LA anterior line) was performed in case of persistent AF with risk factors for recurrence (ie, LA dilation or long duration of persistent AF episode), or in patients with LA low-voltage areas according to operators' preference.[1,10]

Study Outcomes

The primary study end point was atrial tachyarrhythmia (AT, a composite of AF and atrial tachycardia/flutter) recurrence during follow-up, after an 8-week blanking period. The secondary end points included all-cause death, stroke or systemic embolism, acute coronary syndrome, redo ablation during follow-up, AT recurrence off class I/III antiarrhythmic drugs, and any procedure-related complications during the hospitalization and within the first 30 days of follow-up.

These outcomes were assessed by reviewing patients' charts and using follow-up 24-hour Holter monitoring, 12-lead ECG, and clinical evaluations scheduled at 3 months after the index procedure and every 6 months thereafter, as well as device interrogation in cardiac implantable electronic device carriers. Additionally, transtelephonic follow-ups were performed periodically, and patients were instructed to contact the arrhythmia service in case of new-onset arrhythmia symptoms. Under the latter circumstance, additional 12-lead ECG and Holter monitoring was prescribed.

Statistical Analysis

Baseline characteristics between groups were reported as counts (percentages) for categorical variables, and as means±SD or medians (first quartile-third quartile) for normally and nonnormally distributed continuous variables, respectively. Categorical variables were compared using the χ^2 or Fisher's exact test, and continuous variables were compared with Student's *t* test or Wilcoxon rank-sum test, as appropriate.

The covariates entered in the model to compute propensity scores for the 2 cohorts (psoriasis versus no psoriasis) were age, sex, type of AF (paroxysmal versus persistent), CHA_2DS_2-VASc score, indexed LA volume, and the year of catheter ablation (to control for the technologies available for ablation). We used the nearest neighbor method without replacement, and caliper width was set at 0.10.

Event-free survival was evaluated with the Kaplan–Meier method and survival between groups was compared with the log-rank test or permutation log-rank test, as appropriate. Univariable and multivariable Cox regression analysis was performed to assess the association between relevant variables and primary outcome events. The optimal cutoff for continuous variables associated with the primary end point in Cox regression analysis was calculated as the value maximizing the difference between the survival curves of the 2 groups formed by dichotomizing the continuous variable at different possible cutoff points; this difference was evaluated using the log-rank statistic. All statistical analyses were performed in R (R Core Team, Vienna, Austria), using the "MatchIt," "psych," "survival," and "survminer" packages; *P* values <0.05 indicated statistical significance.

RESULTS

Baseline Clinical Data

The study enrolled 48 patients with psoriasis and 96 propensity score-matched controls without psoriasis. Clinical characteristics were well balanced between the study groups (Table 1; Table S2), without any significant

differences in demographic and echocardiographic parameters, except for a higher prevalence of coronary artery disease in the control group.

Briefly, the median age was 66 (56–72) and 63 (55–70) years in the psoriasis and control groups, respectively, and approximately 20% of patients were female. Paroxysmal, persistent, and longstanding persistent AF types had similar prevalence in the study groups (psoriasis: paroxysmal, n=25 [52%], persistent, n=21 [44%], longstanding persistent, n=2 [4%]; control group: paroxysmal, n=51 [53%], persistent, n=42 [44%], longstanding persistent, n=3 [3%]; all *P*=NS). The median LA volume was 40 (32–45) mL/m^2 in the psoriasis group and 38 (30–45) mL/m^2 in control group (*P*=0.518), and the median left ventricular ejection fraction was 59% (53%–60%) in the psoriasis group and 60% (55%–60%) in the control group (*P*=0.722).

The average duration of psoriasis at index hospitalization for ablation was 5 years (2.5–9.0), and 38% of patients had a history of psoriatic arthritis. In the group with psoriasis, no patients reported hospitalization for psoriasis, and 21% of patients were receiving systemic therapies for psoriasis at the time of hospitalization for ablation, most commonly apremilast (n=4, 8%) and methotrexate (n=2, 4%). Furthermore, 22 (46%) patients had previously been treated with biologic therapies, including TNF inhibitors (n=9), IL-23 inhibitors (n=6), IL-17 inhibitors (n=5), and IL-12/23 inhibitor (n=2).

Patients with psoriasis had laboratory evidence of low-grade systemic inflammation, as indicated by elevated preprocedural levels of CRP (C-reactive protein) and erythrocyte sedimentation rate. Specifically, CRP levels were higher in patients with psoriasis (0.85 mg/dL [0.45–1.2]) compared with the control group (0.3 mg/dL [0.3–0.4]; *P*<0.001). Similarly, erythrocyte sedimentation rate was elevated in patients with psoriasis (20 mm/h [20–20]) compared with controls (7 mm/h [7–8]; *P*<0.001). Additionally, the preprocedural white blood cell count was significantly higher in patients with psoriasis (6950/mm^3) than in the control group (5850/mm^3; *P*=0.006).

Procedural Details, Substrate Analysis, and Complications

Procedural details are reported in Table 2. Most commonly, catheter ablation was performed using the SmartTouch SurroundFlow catheter. The procedural strategy encompassed PVI in each patient; additionally, approximately two thirds of the patients received ablation of other structures (PVI-plus; psoriasis: n=32 [67%]; control group: n=61 [64%]). The overall prevalence of PVI-only and PVI-plus strategies was similar in the psoriasis and control groups (PVI-only: psoriasis, n=16 [33%]; control group, n=35 [36%]; *P*=0.339).

Electroanatomical mapping data were available for 50% (n=24) and 41% (n=39) of patients in the psoriasis and control groups, respectively (*P*=0.373). The overall percentage of low-voltage area extension was higher in the group with psoriasis compared with the control group (psoriasis: 20% [11%–20%]; control group: 5% [5%–10%]; *P*=0.013). Furthermore, 14 patients (psoriasis, n=5; control group, n=9) also had complete electroanatomical mapping data from redo procedures after a median of 10 (6–24) months from the index AF ablation. Among them, a nonsignificantly higher percentage of patients with psoriasis showed an increased amount of atrial low-voltage regions that were not ablated in the index procedure (psoriasis, 4/5 [80%]; control group, 4/9 [44%]; *P*=0.3).

Procedure-related complications included 2 femoral arteriovenous fistulas and 1 case of postprocedural Takotsubo syndrome. Both arteriovenous fistulas were managed conservatively with compression. The Takotsubo syndrome was complicated by in-hospital torsades de pointes, and the patient ultimately received an implantable cardioverter-defibrillator. Among these complications, only 1 arteriovenous fistula occurred in the group with psoriasis (overall complications: psoriasis, n=1 [2%]; control group, n=2 [2%]; *P*=1.000). Notably, no periprocedural strokes or thromboembolic complications were observed.

Follow-Up Outcomes and Predictors of the Primary End Point

During a median follow-up of 20 months (13–32), 42 patients (29%) experienced an AT recurrence after the blanking period, with 19 of them in the psoriasis group (Figure 1). Compared with the control group, patients with psoriasis had higher rate of AT recurrence (psoriasis: n=19 [40%]; control group: n=23 [24%]; log-rank *P*=0.023) and a worse 1-year and 2-year Kaplan–Meier estimates of survival free from AT recurrence (psoriasis: 1-year, 56% [42%–73%]; 2-year, 56% [42%–73%]; control group: 1-year, 78% [70%–87%]; 2-year, 76% [67%–86%]). This difference was primarily driven by the subgroups with paroxysmal AF (Figure 1) and PVI-plus (Figure S1). Among patients with recurrences, 26 underwent redo AT ablation during follow-up (psoriasis: n=12 [25%]; control group: n=14 [15%]; *P*=0.193). Early AT recurrences during the blanking period were observed in a similar proportion of patients in the psoriasis and control groups (psoriasis: n=9 [19%]; control group: n=15 [16%]; log-rank *P*=0.813).

At last follow-up, 38 patients (24%) were still on class I/III antiarrhythmic drugs, with a similar distribution in the group with psoriasis and the control group (psoriasis: 16 [33%], control group: 22 [23%]; *P*=0.256). Patients with psoriasis had a higher rate of AT recurrence off antiarrhythmic drugs (log-rank *P*=0.024) and worse Kaplan–Meier estimates of survival free from AT recurrence off class I/III antiarrhythmic drugs

Table 1. Characteristics of the Patients at Baseline

Variable	Psoriasis	Control	*P* value
Patients, n (%)	48 (100)	96 (100)	
Age, y, median (first–third quartile)	66 (56–72)	63 (55–70)	0.293
Female sex, n (%)	10 (21)	19 (20)	1.000
AF type			
Paroxysmal AF, no. (%)	25 (52)	51 (53)	1.000
Persistent AF, no. (%)	21 (44)	42 (44)	1.000
Longstanding persistent AF, no. (%)	2 (4)	3 (3)	1.000
Psoriasis duration, y, median (Q1–Q3)	5 (2.5–9)	…	…
Psoriatic arthritis, no. (%)	18 (38)	…	…
Current systemic therapy for psoriasis, no. (%)	10 (21)	…	…
Apremilast, no. (%)	4 (8)	…	…
Methotrexate, no. (%)	2 (4)	…	…
IL-12/23 inhibitor, no. (%)	1 (2)	…	…
Mometasone, no. (%)	1 (2)	…	…
Cyclosporine, no. (%)	1 (2)	…	…
Acitretin, no. (%)	1 (2)	…	…
Prior systemic therapy for psoriasis, no. (%)	22 (46)	…	…
Tumor necrosis factor inhibitors, no. (%)	9 (19)	…	…
IL-23 inhibitors, no. (%)	6 (13)	…	…
IL-17 inhibitors, no. (%)	5 (10)	…	…
IL-12/23 inhibitor, no. (%)	2 (4)	…	…
Other medical treatments at baseline			
Amiodarone, no. (%)	11 (23)	14 (15)	0.311
Class Ic/III AAD, no. (%)	32 (67)	66 (69)	0.950
Class II AAD, no. (%)	38 (79)	36 (38)	<0.001
Class IV AAD, no. (%)	3 (6)	15 (16)	0.180
Statins, no. (%)	35 (73)	33 (34)	<0.001
Persistent AF episode duration, months	6 (5–11)	6 (3–12)	0.900
Body mass index, kg/m^2, median (Q1–Q3)	27.8 (25.0–31.3)	28.4 (25.3–32)	0.494
Obesity, no. (%)	14 (29)	38 (40)	0.297
Indexed left atrial volume, mL/m^2, median (Q1–Q3)	40 (32–45)	38 (30–45)	0.518
Left ventricular ejection fraction, %, median (Q1–Q3)	59 (53–60)	60 (55–60)	0.722
Mitral regurgitation			
Absent/mild, no. (%)	39 (81)	79 (82)	1.000
Moderate/severe, no. (%)	9 (19)	17 (18)	1.000
Tricuspid regurgitation			
Absent/mild, no. (%)	48 (100)	89 (93)	0.096
Moderate/severe, no. (%)	0 (0)	7 (7)	0.096
Congestive heart failure, no. (%)	11 (23)	21 (22)	1.000
Coronary artery disease, no. (%)	2 (4)	16 (17)	0.034
Arterial hypertension, no. (%)	34 (71)	67 (70)	1.000
Diabetes type 2 – no. (%)	8 (17)	22 (23)	0.514
Dyslipidemia – no. (%)	27 (56)	40 (42)	0.140
Estimated glomerular filtration rate <60 mL/min, no. (%)	4 (8)	3 (3)	0.222
Chronic obstructive pulmonary disease, no. (%)	0 (0)	3 (3)	0.551
CHA_2DS_2-VASc score, median (Q1–Q3)	3 (2–4)	2 (1–3)	0.065

(*Continued*)

Table 1. Continued

Variable	Psoriasis	Control	*P* value
Preprocedural laboratory data			
C-reactive protein, mg/dL, median (Q1–Q3)	0.85 (0.45–1.2)	0.3 (0.3–0.4)	<0.001
Erythrocyte sedimentation rate, mm/h median (Q1–Q3)	20 (20–20)	7 (7–8)	<0.001
White blood cell count, n/mm^3, median (Q1–Q3)	6950 (5600-7870)	5850 (5100-7400)	0.006
Hemoglobin, g/dL mean±SD	13.6±1.6	13.7±1.5	0.733
Platelet n/mm^3, median (Q1–Q3)	210000 (169000–234500)	200000 (166500–229000)	0.563
Red blood cell distribution width, %, median (Q1–Q3)	13.2 (12.6–14)	12.9 (12–13.6)	0.052
Uric acid, mg/dL, median (Q1–Q3)	6.4 (5.2–7.4)	5.6 (4.7–7)	0.243
Cardiac implantable electronic device, no. (%)	10 (21)	20 (21)	1.000

AAD indicates antiarrhythmic drug; AF, atrial fibrillation; and IL, interleukin.

(psoriasis: 1-year, 42% [30%–59%]; 2-year, 42% [30%–59%]; control group: 1-year, 65% [56%–76%]; 2-year, 63% [53%–74%]) (Figure 2).

Regarding modes of AT recurrence, 29 out of 42 patients experienced AF recurrence (psoriasis: 12/19, control group: 17/23; *P*=0.678), whereas 15 out of 42 patients had atrial flutter recurrence, with typical and atypical ECG patterns identified in 2 and 14 patients, respectively (psoriasis: 7/19, control group: 8/23; *P*=1.000). Two patients experienced both AF and atrial flutter recurrence during follow-up. The Kaplan–Meier curves illustrating survival free from recurrent AF and atrial flutter are shown in Figure S2.

Table 2. Procedural Details and Complications

Variable	Psoriasis n=48	Control n=96	*P* value
Preprocedural transesophageal echocardiography, no. (%)	21 (44)	40 (42)	0.953
Energy source for ablation			
Radiofrequency energy, no. (%)	48 (100)	96 (100)	1.000
Ablation catheter			
SmartTouch SurroundFlow, no. (%)	39 (81)	69 (72)	0.307
Tacticath, no. (%)	6 (13)	19 (20)	0.392
QDOT Micro, no. (%)	2 (4)	4 (4)	1.000
Tactiflex, no. (%)	1 (2)	4 (4)	1.000
Skin-to-skin procedure time, min, median (Q1–Q3)	115 (100–129)	123 (106–150)	0.104
Total fluoroscopy time, min, median (Q1–Q3)	13 (10–24)	15 (7–23)	0.835
Radiofrequency time, min, median (Q1–Q3)	23 (18–35)	32 (19–48)	0.071
Procedural strategy			
PVI-only, no. (%)	16 (33)	35 (36)	0.339
PVI-plus, no. (%)	32 (67)	61 (64)	0.339
Cavotricuspid isthmus line, no. (%)	7 (15)	6 (6)	0.125
Electroanatomical mapping data available, no. (%)	24 (50)	39 (41)	0.373
Overall percentage extension of left atrial low-voltage areas, % median (Q1-Q3)	20 (11–20)	5 (5–10)	0.013
Any complications, no. (%)	1 (2)	2 (1)	1.000
Femoral arteriovenous fistula, no. (%)	1 (2)	1 (1)	1.000
Postprocedural Takotsubo syndrome, no. (%)	0 (0)	1 (1)	1.000

PVI indicates pulmonary vein isolation.

Cox regression analysis was performed to identify variables associated with AT recurrence after the blanking period (Table 3 and Figure 3). Variables positively associated with the primary end point in univariable analysis included history of psoriasis, preablation CRP, erythrocyte sedimentation rate, and early AT recurrence during blanking period. The association of psoriasis (adjusted hazard ratio [aHR], 2.2 [1.0–4. 8], *P*=0.046), CRP (aHR, 1.2 [1.0–1.3], *P*=0.016), and AT recurrence during the blanking period (aHR, 6.9 [3.4–13.9], *P*<0.001) was retained in the final multivariable model based on a 0.05 alpha level (Figure 3). In the psoriasis group (Table S3), the optimal preablation CRP cutoff was found to be 1 mg/dL. This value yielded a sensitivity of 0.63, a specificity of 0.86, a positive predictive value of 0.75, and a negative predictive value of 0.78 (Figure 4). Remarkably, survival free from AT recurrence in patients with psoriasis with pre-ablation CRP >1 mg/dL was 15% [4%–53%] compared with 76% [62%–93%] in patients with lower CRP levels (*P*<0.001; Figure 4).

Regarding other secondary end points, there was 1 death due to COVID-19 in the control group (permutation log-rank test *P*=0.517) and 3 acute coronary syndromes (2 in the group with psoriasis, for a prevalence of 4%; permutation log-rank *P*=0.035), whereas no stroke or systemic embolism was observed. Among the 48 patients with psoriasis, 44 (92%) were still taking oral anticoagulants at last-follow-up.

DISCUSSION

To the best of our knowledge, this study represents the first systematic evaluation of clinical outcomes after

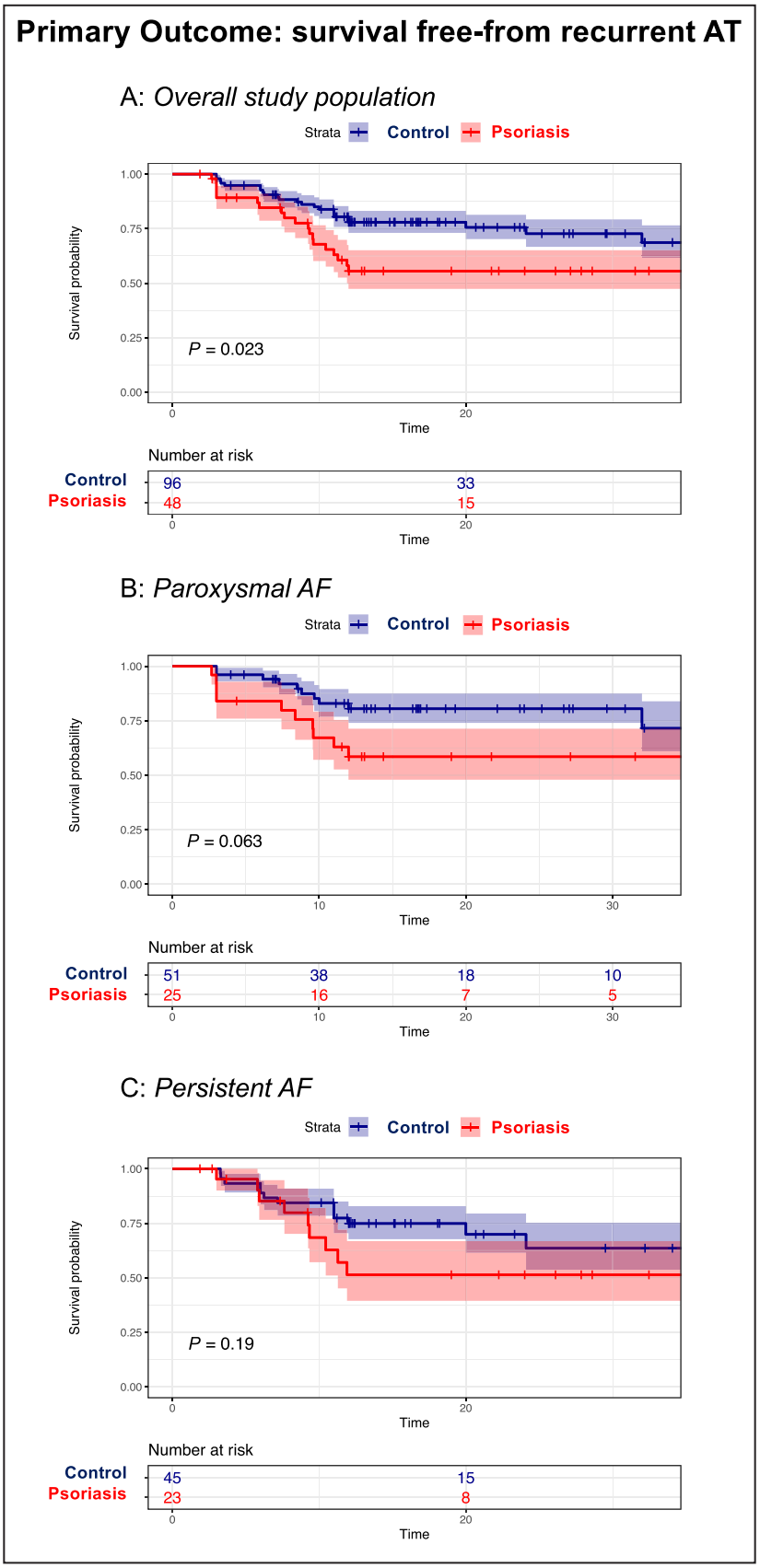

Figure 1. Atrial tachyarrhythmia-free survival after ablation.
Atrial tachyarrhythmia-free survival in all study population (**A**), in paroxysmal AF patients (**B**) and in persistent AF patients (**C**). AF indicates atrial fibrillation; and AT, atrial tachyarrhythmia.

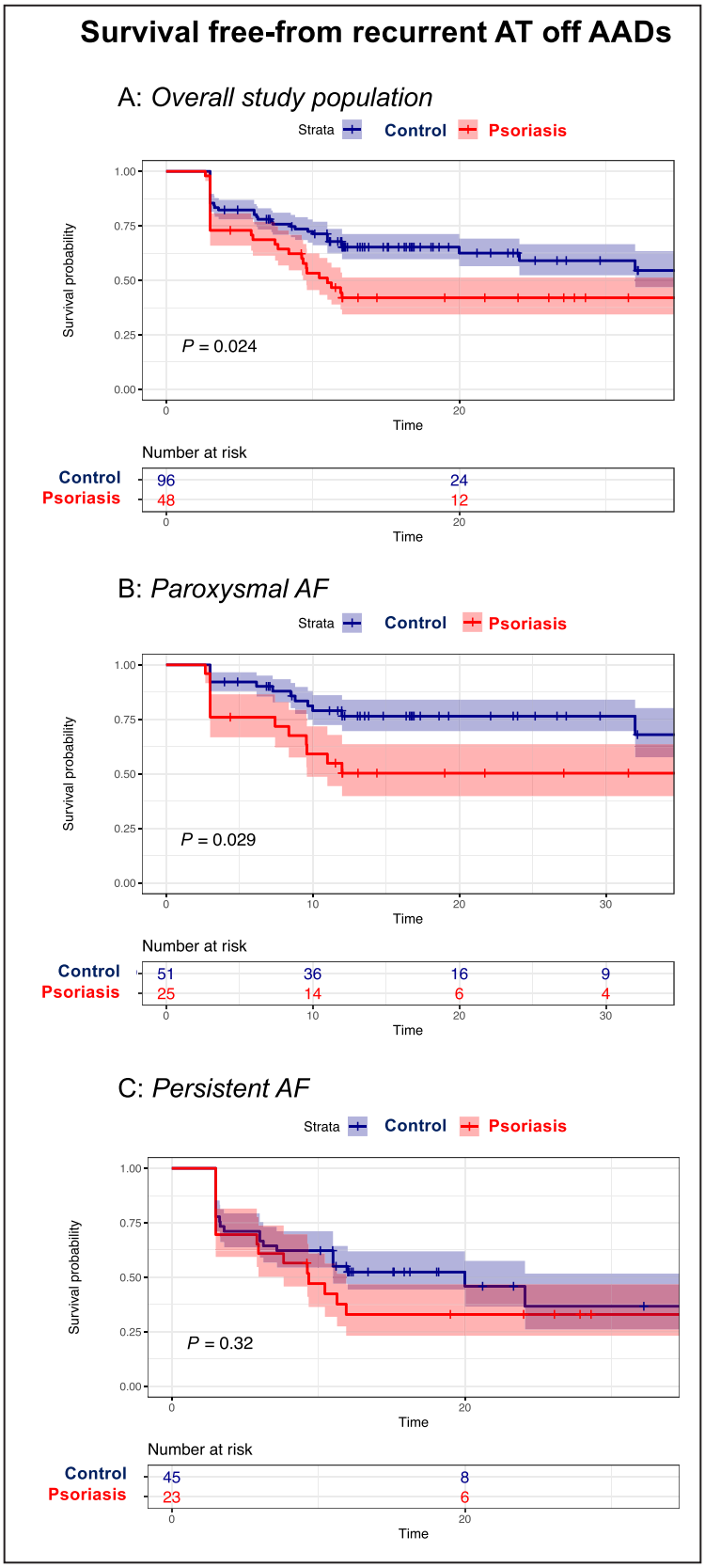

Figure 2. Atrial tachyarrhythmia-free survival off antiarrhythmic drugs.
Atrial tachyarrhythmia-free survival off AADs in all study population (**A**), in paroxysmal AF patients (**B**) and in persistent AF patients (**C**). AAD indicates antiarrhythmic drug; AF, atrial fibrillation; and AT, atrial tachyarrhythmia.

Table 3. Univariable and Multivariable Cox Regression Analysis of the Primary Outcome (Atrial Tachyarrhythmia Recurrence After 8-Week Blanking Period)

Variable	Univariable analysis			Multivariable analysis		
	HR	95% CI	*P* value	HR	95% CI	*P* value
Age (per unit change)	1.0	1.0–1.0	0.266			
Sex (male vs female)	0.8	0.4–1.7	0.617			
Type of atrial fibrillation (persistent vsparoxysmal)	1.2	0.7–2.3	0.480			
Psoriasis (vs no psoriasis)	2.0	1.1–3. 7	0.026	2.2	1.0–4.8	0.046
Psoriatic arthritis (vs no psoriatic arthritis)	1.5	0.7–3.4	0.335			
Current or prior systemic therapy for psoriasis (yes vs no)	0.3	0.1–1.4	0.142			
Body mass index (per unit change)	1.0	0.9–1.1	0.940			
Obesity (yes vs no)	1.1	0.6–2.0	0.791			
Indexed left atrial volume (per unit change)	1.0	1.0–1.0	0.356			
Left ventricular ejection fraction (per unit change)	1.0	1.0–1.0	0.493			
Mitral regurgitation grading						
Mild (vsabsent/trivial)	1.4	0.7–2.8	0.340			
Moderate (vsabsent/trivial)	1.3	0.5–3.2	0.567			
Severe (vsabsent/trivial)	3.0	0.7–13.1	0.148			
Congestive heart failure (yes vs no)	0.8	0.4–1.7	0.584			
Coronary artery disease (yes vs no)	1.3	0.6–3.0	0.485			
Arterial hypertension (yes vs no)	1.7	0.8–3.5	0.163			
Diabetes type 2 (yes vs no)	0.9	0.4–1.8	0.674			
CHA_2DS_2-VASc score (per unit change)	1.1	0.9–1.4	0.300			
Chronic kidney disease (estimated glomerular filtration rate <60 mL/min – yes vs no)	1.1	0.3–4.7	0.871			
Chronic obstructive pulmonary disease (yes vsno)	1.8	0.2–6.8	0.514			
Laboratory data						
C-reactive protein (per unit change)	1.2	1.1–1.3	<0.001	1.2	1.0–1.3	0.016
Erythrocyte sedimentation rate (per unit change)	1.0	1.0–1.1	0.016	1.0	0.96–1.02	0.421
White blood cell count (per 1000 change)	1.1	0.9–1.3	0.393			
Hemoglobin (per unit change)	1.1	0.9–1.4	0.291			
Platelet (per 1000 change)	1.0	1.0–1. 0	0.157			
Red blood cell distribution width (per unit change)	1.1	1.0–1.2	0.220			
Uric acid (per unit change)	1.0	1.0–1.0	0.471			
Creatinine (per unit change)	1.7	0.3–8.8	0.527			
Lymphocytes (per 1000 change)	1.0	0.7–1.5	0.993			
Medical treatments at baseline						
Amiodarone (yes vsno)	1.3	0.6–2.7	0.515			

(*Continued*)

Table 3. Continued

Variable	Univariable analysis			Multivariable analysis		
	HR	95% CI	*P* value	HR	95% CI	*P* value
Class Ic/III AAD (yes vs no)	0.9	0.5–1.8	0.840			
Class II AAD (yes vs no)	1.2	0.6–2.1	0.618			
Class IV AAD (yes vs no)	1.1	0.4–2.3	0.854			
Statins (yes vs no)	1.3	0.7–2.3	0.429			
Ablation strategy						
PVI-plus (vs PVI-only)	1.1	0.6–2.1	0.759			
Early recurrence during blanking (yes vs no)	5.9	3.1–11.2	<0.001	6.9	3.4–13.9	<0.001

AAD indicates antiarrhythmic drug; HR, hazard ratio; and PVI, pulmonary vein isolation.

a rhythm control strategy (ie, catheter ablation) in patients with psoriasis and AF. Our findings suggest several key messages for clinicians:

1. Patients with psoriasis face a very high risk of AT recurrence after catheter ablation at referral institutions.
2. This risk exceeds that of a matched cohort of patients without psoriasis, and psoriasis was found to be independently associated with AT recurrence in multivariable analysis.
3. The electroanatomical substrate underpinning AF among patients with psoriasis is characterized by larger LA low-voltage regions compared with control patients.
4. Patients with psoriasis show laboratory evidence of low-grade inflammation. CRP, a widely available marker of inflammation, emerged as an independent variable associated with AT recurrence in multivariable analysis.
5. During approximately 2 years of follow-up, there were no strokes or systemic embolisms. However, patients with psoriasis had a slightly higher risk of acute coronary syndrome, highlighting the importance of proper atherosclerotic risk assessment and treatment among patients with psoriasis and AF.

With an overall prevalence of 2% to 3%, psoriasis is one of the most common chronic inflammatory disorders, affecting approximately 125 million people worldwide.[15] Pathophysiologically, the disease is a prototypical example of T-helper lymphocyte-mediated inflammation leading to psoriatic plaque formation.[15] Compelling evidence now supports the concept that systemic inflammation is a common occurrence in psoriatic patients.[15] The hypothesis of "psoriatic march,"[16] indicating the cutaneous-to-systemic progression of inflammation, has been proposed to explain the common association between psoriasis and metabolic and cardiovascular comorbidities.[15,16]

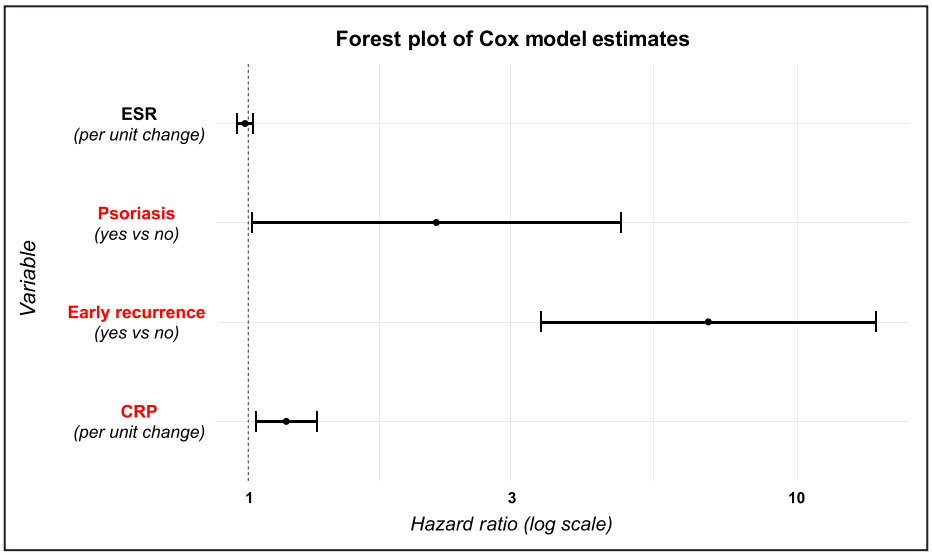

Figure 3. Variables associated with atrial tachyarrhythmia recurrence in multivariable analysis.
CRP indicates C-reactive protein; and ESR, erythrocyte sedimentation rate.

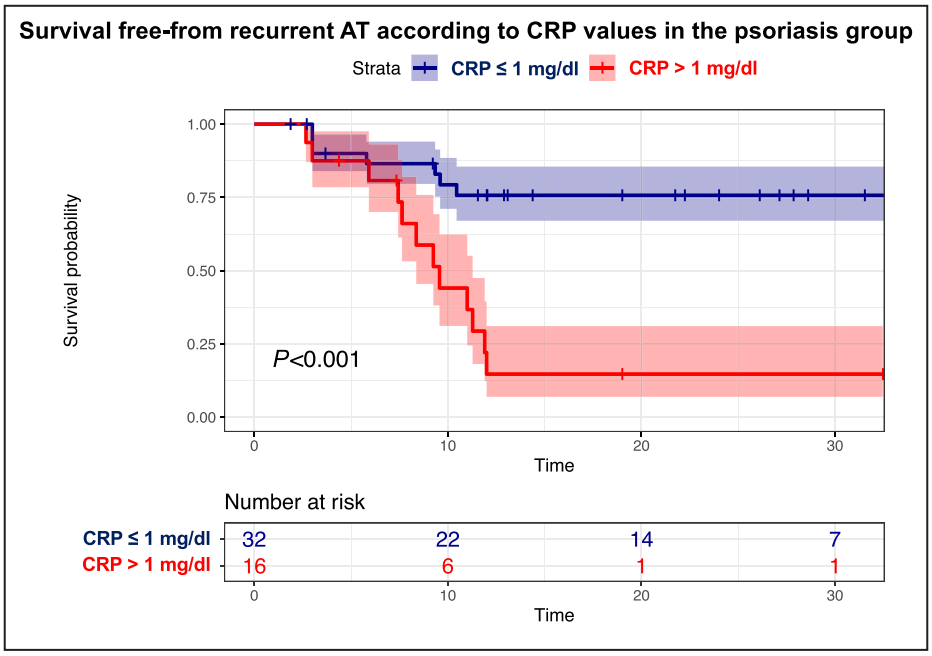

Figure 4. Atrial tachyarrhythmia recurrence according to C-reactive protein values in the psoriasis group.
AT indicates atrial tachyarrhythmia; and CRP, C-reactive protein.

Interestingly, recent studies involving accurate immunohistological analyses of LA appendage tissue have demonstrated increased T-cell infiltration in patients with AF compared with controls in sinus rhythm.[17,18] This finding is consistent with inflammation-related atrial cardiomyopathy, which may provide a potential pathophysiological link between T-cell mediated inflammation and AF recurrence in patients with psoriasis and AF.[19] Furthermore, an expansion of atrial epicardial adipose tissue mass, commonly associated with metabolic syndrome, a condition often accompanying psoriasis, may exert paracrine proinflammatory and profibrotic effects, favoring AT recurrence after ablation.[19–21]

Our findings of worse electroanatomical markers of atrial cardiomyopathy (ie, a greater relative extension of LA low-voltage zones) align with previous studies in patients with ankylosing spondylitis,[22] inflammatory bowel disease,[23] and HIV infection.[24] These studies reported significant abnormalities in atrial electromechanical function, suggesting direct involvement of the atrial wall by the inflammatory process.[19] Our study also supports previous findings on catheter ablation of AF in patients with systemic inflammatory disorders, such as rheumatoid arthritis,[25] in which higher AT recurrence rates were reported. This reinforces the concept that LA ablation using thermal energy may not resolve the pathophysiological processes underpinning inflammation-related atrial cardiomyopathy.[19] Whether a recently-introduced ablation energy source, pulsed field ablation, which is associated with a lower postablation proinflammatory and profibrotic response, may yield more favorable outcomes in patients with inflammation-associated atrial cardiomyopathy is an important research question that future studies will need to address.[26–28]

Our findings indicate that elevated baseline levels of widely available laboratory markers of inflammation, such as CRP, are significantly associated with an increased risk of AT recurrence post ablation, particularly in patients with psoriasis with preablation CRP >1 mg/dL. This observation corroborates previous reports[29] and may underscore the need to optimize the pharmacological control of inflammatory disease activity using disease-modifying drugs before proceeding with catheter ablation in patients with psoriasis and AF. Among possible strategies, prescribing biologic drugs among patients with moderate to severe psoriasis or psoriatic arthritis may offer particular value.[15,30] Notably, TNF-α inhibitors have been associated with a reduced risk of myocardial infarction in psoriasis patients, whereas IL-17A inhibitors have demonstrated improved myocardial function in nonrandomized studies.[30] However, the beneficial effects of these agents on rhythm outcomes in patients with psoriasis and AF require formal testing in future studies.[19] The prescription of additional anti-inflammatory drugs, such as colchicine, postablation has been proposed as a strategy to reduce postprocedural pericarditis and AT recurrence. However, recent data from a randomized, placebo-controlled trial enrolling an all-comers population of patients with AF

receiving thermal ablation showed no benefits of postprocedural colchicine in terms of rhythm outcomes.[31] Whether a postablation course of colchicine (or other anti-inflammatory drugs) may benefit patients with AF and systemic inflammatory disorders remains to be clarified in future studies. It is plausible to speculate that anti-inflammatory medications might have a synergistic effect with postprocedural antiarrhythmic drugs, facilitating the maintenance of sinus rhythm after PVI in the challenging context of inflammation-related atrial cardiomyopathy.[19]

Although no stroke or systemic embolisms were observed in our cohort, likely due to the almost universal prescription of anticoagulant drugs throughout follow-up, patients with psoriasis had a significantly higher risk of acute coronary syndrome compared with controls, despite a lower baseline prevalence of coronary artery disease. This finding warrants aggressive management of atherothrombotic risk factors in this peculiar cohort.[30]

Limitations

Several limitations of our work should be acknowledged. First, our analysis had a limited sample size and, therefore, limited statistical power. However, this study is the result of a multicenter collaboration among international institutions, and the number of enrolled patients aligns with previous reports concerning catheter ablation for AF in other chronic systemic inflammatory diseases.[25] Second, due to the retrospective, observational design of the study, selection bias cannot be completely ruled out. Nonetheless, propensity score matching was employed to control for measured confounders. Future prospective studies enrolling patients with psoriasis and AF should investigate the roles of an optimized disease-modifying strategy preablation, anti-inflammatory medications such as colchicine postprocedure, and novel ablation energy sources such as pulsed electric field energy to increase the success of AF ablation in this unique population. Third, the medical management of patients, as well as the ablation lesion sets were not prespecified, limiting our ability to ascertain their impact on clinical outcomes. Fourth, although the duration of follow-up was adequate to investigate AT recurrence, it may not have been sufficient to fully capture the long-term risk of hard clinical end points such as mortality or stroke.[32]

CONCLUSIONS

Catheter ablation is associated with a high risk of recurrence among patients with psoriasis and AF. The electrophysiological LA substrate of patients with psoriasis and AF is characterized by a high burden of low-voltage electrograms. In our sample, patients with psoriasis showed laboratory evidence of low-grade inflammation and preprocedural CRP was significantly associated with postablation AT recurrence in multivariable analysis. These findings suggest that chronic systemic inflammation may play an important role in determining the response to catheter ablation and underscore the need for multidisciplinary management of patients with AF and psoriasis.

ARTICLE INFORMATION

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Supplemental Material

Tables S1–S3
Figure S1–S2

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