Original Investigation Reports

Multicenter catheter ablation registry in Argentina

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ABSTRACT

Introduction: electrophysiology has had constant growth in recent years, both in diagnostic and therapeutic methods. This leads to the need for registries that can provide representative data of the therapeutic procedures performed in a large number of medical centers in Argentina. The objective of the registry is to provide updated information on the current status of catheter ablation in the different centers in Argentina. In this new edition, as in the previous one, the 3 scientific societies, FAC, SAC and SADEC are present in the preparation of the registry.

Methods: retrospective registry of catheter ablation procedures performed between January 1 and December 31, 2023 in centers in Argentina. The data were obtained through a standardized Google form that was sent via email and telephone to the participating centers.

Results: 894 ablation procedures performed in 19 centers in 8 regions of Argentina were analyzed. Unlike the previous registry and similar to current registries in Latin America, the most frequent substrate was atrial fibrillation ablation. The overall success rate was 96% and 97.65% of the procedures were free from complications.

Conclusions: an adequate and immediate global success rate of 96% was observed, which was 94.71% in the previous registry. The overall success rate, as well as in the different substrates, is similar to international multicenter reports. An increase in the number of procedures in all substrates was observed in 2023 compared to 2020, with Atrial Fibrillation being the substrate that grew the most. A systematic continuation of carrying out future registries is essential to evaluate the results and direction of electrophysiology in the centers of Argentina.

ABREVIATURAS:
INRT: intranodal reentry tachycardia
AVN: atrioventricular node
AVNRT: atrioventricular nodal reentry tachycardia
FAT: focal atrial tachycardia
AFL: atrial flutter
AFib: atrial fibrillation
VA: ventricular arrhythmias.

INTRODUCTION

Electrophysiology has constantly grown in recent years, both in diagnostic and therapeutic methods. This leads to requiring registries that can provide representative data on catheter ablation, a therapeutic procedure that is performed in plenty of medical centers in Argentina.[1,2,3,4]

The multicenter registry on catheter ablation of Argentina has the goal of providing updated information on the

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current state of catheter ablation in the different centers of Argentina. In this new edition, just as with the previous one, doctors from the three scientific societies, FAC, SAC and SADEC are present to construct the registry.

MATERIALS AND METHODS

This new edition of the multicenter registry of catheter ablation, just as with the previous one, was carried out retrospectively. All electrophysiologists of Argentina were invited to participate willingly, through a standardized Google form, which was sent by e-mail and phone, facilitating data upload in comparison with the previous one. They were invited to enter data to the form, about the ablation procedures made from January 1 to December 31, 2023. The participating centers were not required to express their written or oral commitment in regard to the increase in the total of procedures performed in their center. Registry data were processed anonymously by its authors.

Just as with the 2019-2020 registry, the different cardiac rhythm alterations were classified into 7 categories, facilitating data gathering and the subsequent analysis: intranodal reentry tachycardia (INRT), atrioventricular node (AVN), atrioventricular nodal reentry tachycardia (AVNRT), focal atrial tachycardia (FAT), atrial flutter (AFL), atrial fibrillation (AFib) and ventricular arrhythmias (VA).

Procedures were considered successful when the substrate was removed and/or post-ablation arrhythmia could not be induced; and for atrial fibrillation, when pulmonary veins were isolated.

Complications included conduction disorders (branch block, 2nd degree AV block, types I, II, 2:1 or high degree and complete heart block), vascular disorders related to access (hematoma, fistula, pseudoaneurysm), pericardial effusion, cardiac tamponade, pericarditis, myocardial infarction, transient ischemic attack and stroke, pulmonary vein stenosis, bleeding, atrioesophageal fistula, esophageal injury, gastrointestinal motility alteration, phrenic nerve paralysis, mediastinitis, death and other complications.

The technique used, the approach, type of energy used, echocardiographic assistance during ablation, acute success (at the end of the procedure), type of ablation catheter used, and number and type of complications, including peri-procedure death, were the most common variables analyzed. Specific variables in certain substrates like the type, location or underlying heart diseases were the specific variables. The use of fixed or mobile electroanatomic mapping systems was evaluated, and if procedures were carried out without fluoroscopy.

Data were expressed as percentage for categorical variables and as mean or median for continuous variables.

RESULTS

Characteristics of participating centers

In this edition of the registry, 19 centers participated, from 8 Argentinian regions (Buenos Aires, CABA, Córdoba, Corrientes, Mendoza, Neuquén, Santa Fe and Misiones) *(Figure 1).* From all 19 participating centers, 73.6% (14/19) belong to the private sector, 15.7% (3/19) to the public sector and 10.5% (2/19) belonged to both health care sectors *(Table 1);* 47.3% (9/19) of these centers train electrophysiologists (6 private centers, 2 public ones, and 1 that belongs to both sectors); 94.7% (18/19) of participating centers reported cardiovascular surgery availability during the analyzed period. Anesthesia was available in all centers. Most centers (68%, 13/19) included in the registry do not have an electrophysiology laboratory exclusively; but from all centers, 7 had more than 1 interventional radiology suite available, and 2 centers even had 3 suites available. From all the participating centers, 3 presented more than 1 fluoroscopy device, and one even had 3 devices available. The fluoroscopy devices available were: fixed C-arm 31.5% (6/23), portable C-arm 15.7% (3/23), rotational angiography 73.6% (14/23). Just 2 (10.5%) centers did not have non-fluoroscopic navigation systems, 8 (32.1%) had fixed C-arm and 9 (47.3%) had a mobile C-arm. Five centers had more than 1 navigational system available, and one had 3 systems. Intracardiac echocardiography was available in 31.5% (6/19), and cryoablation in 47.36% (9/19). Ablation by ultrasound was not available in any center.

From the participating centers, 89.4% (17/19) had floor nurses available, 84.2% (16/19) had floor technicians, and just 21% (4/19) had floor engineers.

GENERAL RESULTS

In this new edition, the number of participating centers was maintained in comparison to the previous one, although from the total, the participating centers were not the same, a situation observed in other registries where the fluctuation of ablations and participating centers becomes evident.[1,3] The total of ablations performed was 894, an increase from the data obtained in 2020 (623 ablations), not reaching the number of ablations from 2019 (1044), the stage previous to the Covid-19 pandemic *(Figures 2 through 4).* The most frequent substrate, unlike previous registries, with a noticeable increase, was AFib, representing 27% (242/894), and the second most frequent substrate was AFL. All ablated substrates, except for FAT, have increased in regard to the previous registry. The energy used most frequently is still RF, with 86%, with cryoablation representing the remaining 14%; 89.4% (17/19) have non-fluoroscopic navigation systems, whether fixed or mobile; cryoablation system was present in 9 centers, and intracardiac echocardiography in 6. Global and immediate success in the electrophysiology laboratory was 96%. In *Figure 5,* success of ablation per substrate and year are included. There was 97.65% of procedures with no complications, as observed in *Figure 6.*

Results, substrates and arrhythmogenic circuits

Tachycardia by intranodal reentry

INRT ablation is the third most frequent substrate, representing 20% (177/894) of procedures. This substrate was present in all centers and in 69% of cases, just as in

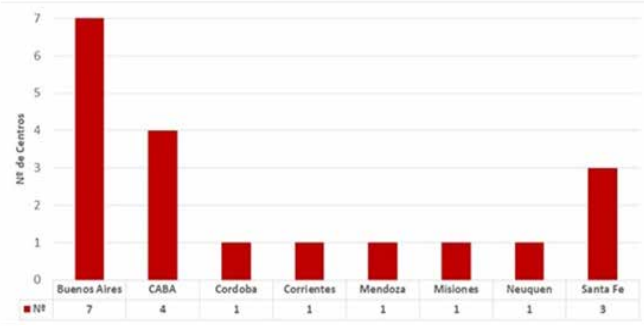


FIGURE 1.
Number of centers per regions participating in the 2023 ablation registry

the previous registries where the female gender prevailed. From the 177 ablations, 171 were the first, and just 6 were reablations; 97% (172/177) was made with conventional technique and just 3% (5/177) was made with non-fluoroscopic mapping systems. The only vascular access used was IV. The energy used most frequently was radiofrequency (RF) (163/177), and second, cryoablation (14/177) unlike the previous registry, where just RF was used for this substrate. Non-irrigated ablation catheter was used in 90% (159/177) and irrigated in 2% (4/177); the remaining cases (14/177) represent cryoablation catheters. From the total procedures, only in 8 cases echocardiogram was used to guide the procedure; in 4 cases peripheral venous contrast echocardiography was used, and in 4 cases, intracardiac echocardiography. The global success of the procedure was 99.4%, maintaining the efficacy of the registry from 2020. A complication arose, a pseudoaneurysm, representing 0.6%. After the ablation of this substrate, in 4% (8/177) of cases, additional substrates were ablated: 6 atrial tachycardias and 2 atrial flutters.

Atrioventricular node ablation

Eighteen AVN ablations were carried out during the registry. IV access and conventional technique with RF were carried out in all procedures. No non-fluoroscopic mapping systems were used, and the most used catheters were non-irrigated (13/18). No contact force-sensing catheters were used. Success was 100%, just as in the previous registry. Complications were present in 11.1% (2/18): 1 hematoma and 1 pseudoaneurysm. A procedure was accompanied by cardioverter defibrillator implant, with cardiac resynchronization system, and transesophageal echocardiogram (TEE) was used to guide the procedure. No additional substrate ablations were made.

Atrial tachycardia

FAT, just as in the previous registry, was the sixth ablated substrate during 2023, representing 4% (38/894) of all cases. This substrate is still more frequent in the female gender, with 61% of cases. The most frequent location was in the right atrium, with 78.9% (30/38) (10 crista terminalis, 10 coronary sinus, 3 right atrial appendage, 3 right atrial base, 3 right free wall and 1 vena cava) and in the left atrium 21.1% (8/38) (5 left atrial base, left free wall and 1 left atrial appendage). In all patients IV access was used. All patients with substrates located in the left atrium were approached by transseptal access. Just as with the previous registry, RF was the energy used most frequently; just 1 case was made with cryoablation (right free wall). The non-fluoroscopic mapping system was used in 53% (20/38) of cases. Non-

TABLE 1
General characteristics of centers

General characteristics (n 19)	
Financing	
Public n (%)	3 (15,78)
Private n (%)	14 (73,68)
Both n (%)	2 (10,52)
Availability of heart surgery n (%)	18 (94,73)
Availability of anesthesia n (%)	19 (100)
Center with training for electrophysiologists n (%)	9 (47,36)
Laboratory staff	
N° of physicians (electrophysiologists)	3
N° nurses	2
N° technicians	2
N° engineers	0-1
Belonging to a group of electrophysiologists?	
Yes n (%)	16 (84,21)
Technical resources	
Room availability	
Exclusive n (%)	6 (31,57)
N° of rooms available	1,47
Fluoroscopy device	
Fixed arm n (%)	6 (31,57)
Portable arm n (%)	3 (15,78)
Rotational angiography n (%)	14 (73,68)
Non-fluoroscopic navigation systems available	
No n (%)	2 (10,52)
Mobile n (%)	9 (47,36)
Fixed n (%)	8 (42,10)
Non-fluoroscopic navigation systems	23
Carto n (%)	5 (21,73)
Ensite n (%)	14 (60,86)
Columbus n (%)	4 (17,39)
Additional equipment	
Intracardiac echocardiography n (%)	6 (40)
Cryoablation n (%)	9 (47.36)
Ablation by ultrasound n (%)	0 (0)
No n (%)	9 (47,36)

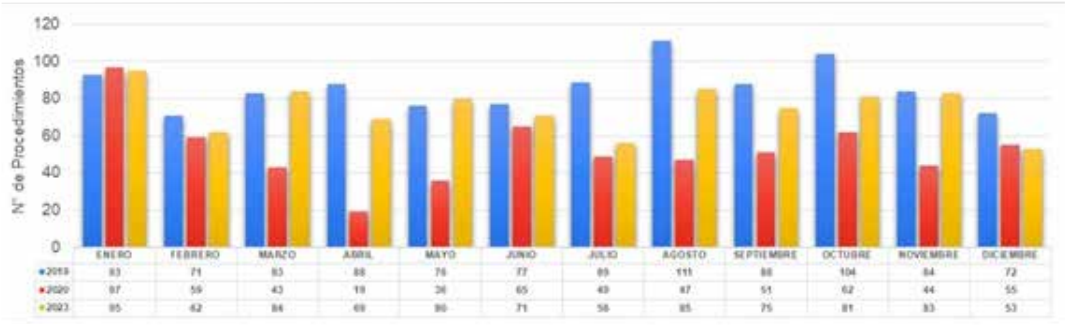


FIGURE 2.
Number of procedures per month and year carried out during the 2019/2020 and the 2023 registries

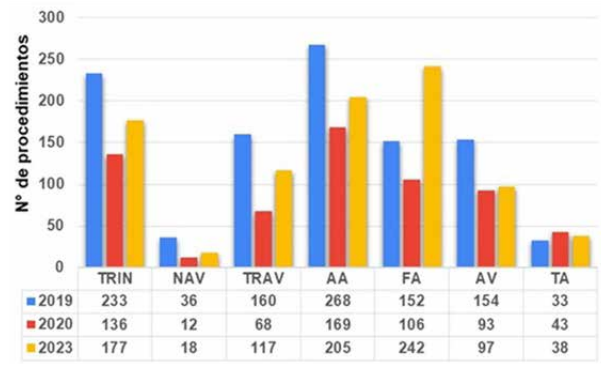


FIGURE 3.
Number of procedures per year according to the substrate made during the 2019/2020 and the 2023 ablation registries

INRT: intranodal reentry tachycardia; **AVN:** atrioventricular node; **AVNRT:** atrioventricular nodal reentry tachycardia; **FAT:** focal atrial tachycardia; **AFL:** atrial flutter; **AFib:** atrial fibrillation; **VA:** ventricular arrhythmias.

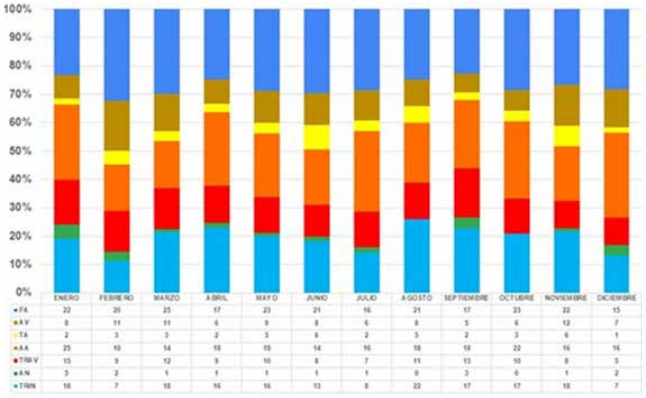


FIGURE 4.
Relative frequency of the different substrates treated during the ablation registry per month during 2023

INRT: intranodal reentry tachycardia; **AVN:** atrioventricular node; **AVNRT:** atrioventricular nodal reentry tachycardia; **FAT:** focal atrial tachycardia; **AFL:** atrial flutter; **AFib:** atrial fibrillation; **VA:** ventricular arrhythmias.

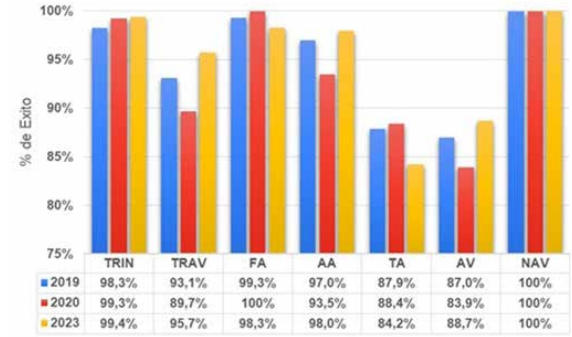


FIGURE 5.
Success of catheter ablation according to the substrate treated per year made, during the 2019/2020 and the 2023 ablation registries.

INRT: intranodal reentry tachycardia; **AVN:** atrioventricular node; **AVNRT:** atrioventricular nodal reentry tachycardia; **FAT:** focal atrial tachycardia; **AFL:** atrial flutter; **AFib:** atrial fibrillation; **VA:** ventricular arrhythmias.

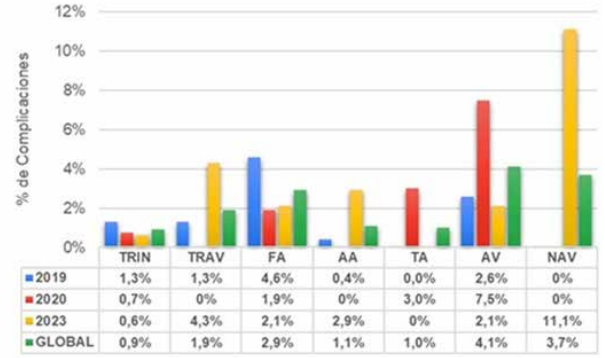


FIGURE 6.
Percentage of complications of catheter ablation according to the substrate treated per year made during the 2019/2020 and 2023 ablation registries.

INRT: intranodal reentry tachycardia; **AVN:** atrioventricular node; **AVNRT:** atrioventricular nodal reentry tachycardia; **FAT:** focal atrial tachycardia; **AFL:** atrial flutter; **AFib:** atrial fibrillation; **VA:** ventricular arrhythmias.

irrigated catheters were used in 50% (19/38) of cases; irrigated no-contact-force sensing catheter in 21.05% (8/38), and with contact-force sensing in 26% (10/38). In 34% (13/38) of cases, echocardiography was used to guide the procedure (8 intracardiac echocardiography and 5 peripheral venous contrast echocardiography). The global success of this substrate is 82.4%. No complications related to this procedure were recorded. In 3 patients, additional substrate ablation was carried out (1 INRT, 1 AFL and 1 AVN).

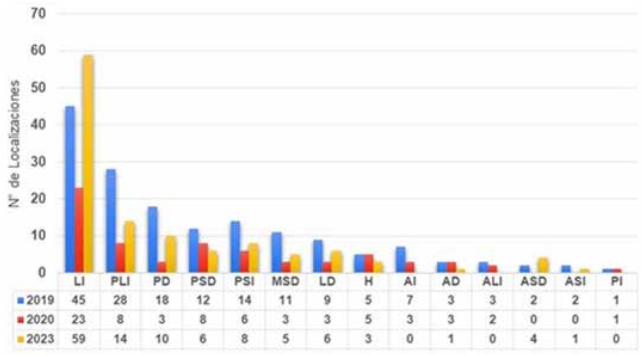


FIGURE 7.
Distribution of accessory pathways per year made during the 2019/2020 and the 2023 ablation registries

LL: left lateral; **LPL:** left posterolateral; **RP:** right posterior; **RPS:** right posteroseptal; **LPS:** left posteroseptal; **RMS:** right mid-septal; **RL:** right lateral; **H:** His bundle; **LA:** left anterior; **RA:** right anterior; **LAL:** left anterolateral; **RAS:** right anteroseptal; **LAS:** left anteroseptal; **LP:** left posterior.

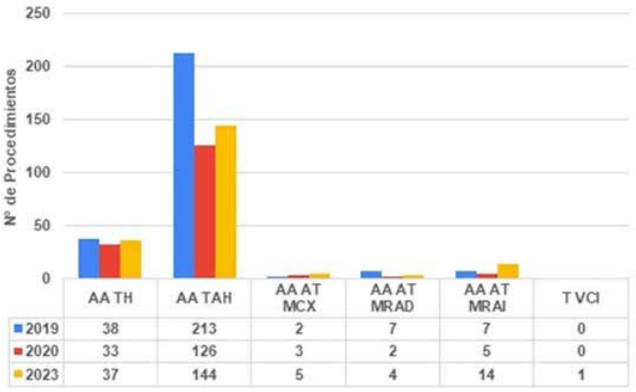


FIGURE 8.
Frequency of atrial flutters per year

CW T-AFL: clockwise typical atrial flutter; **CCW T-AFL:** counterclockwise typical atrial flutter: **MR A-AFL Sx:** macroreentrant atypical atrial flutter by surgery; **RA MR A-AFL:** right atrium macroreentrant atypical atrial flutter with no atriotomy; **LA MR A-AFL:** left atrium macroreentrant atypical atrial flutter.

Atrioventricular nodal reentry tachycardia

AVNRT represents the fourth most frequent substrate, with 13% (117/894) of all procedures, with its number increasing in regard to the 2020 registry, but not reaching the 2019 number of procedures. This substrate was more frequent in the male gender (63%). From all patients ablated due to AVNRT, 92% (108/117) were first procedure and the remaining 8% (9/117) were reablations; 63.25% (74/117) presented delta wave in ECG, 79% (92/117) presented orthodromic tachycardias, 2% (2/117) antidromic tachycardias, 4% (5/117) both, and 15% (18/117) did not present arrhythmias.

Just as with the previous registry, the left pathways were the most frequent ones with 70.08% (82/117). The locations per frequency were: left lateral 50.4% (59/117), left posterolateral 12% (14/117), right posterior 8.5% (10/117), left posteroseptal 6.8% (8/117), right posteroseptal 5.1% (6/117), right lateral 5.1% (6/117), right mid-septal 4.3% (5/117), right anterospetal 3.4% (4/117), His bundle 2.6% (3/117), right anterior 0.9% (1/117), left anteroseptal 0.9% (1/117), left anterior 0% (0/117), left anterolateral 0% (0/117) and left posterior 0% (0/117) *(Figure 7).*

RF was the most used energy, with 94% (110/117), the remaining 6% (7/117) corresponded to cryoablation. The most frequently used ablation technique was the conventional one in 85% (100/117) of cases. Non-fluoroscopic mapping systems were used in the remaining 15%. Access to left chambers was done by retrograde aortic access in 62.19% (51/82) of cases, and transseptally in 36.58% (30/82). One patient required epicardial access (1/82).

Non-irrigated catheters were used most frequently (96/117); only in 3% (4/117) of patients contact force-sensing catheters were used. In 9.4% (11/117) of the cases, peripheral venous contrast echocardiogram was used, and in 2.6% (3/117), intracardiac echocardiography.

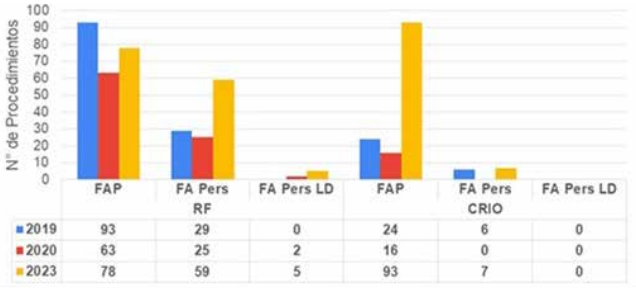


FIGURE 9.
Número de procedimientos por año, presentación clínica y energía utilizada para la ablación.

AFib: atrial fibrillation; **PAF:** paroxysmal atrial fibrillation; **PsAF:** persistent atrial fibrillation; **LSPAF:** long-standing persistent atrial fibrillation; **RF:** radiofrequency; **CRYO:** cryoablation.

The global success of AVNRT ablation was 94.9% (93.1% in 2019 and 89.7% in 2020). Complications appeared in 4.3% of cases (3 hematomas, 1 pseudoaneurysm and 1 conduction disorder [right bundle branch block]). In just 1 patient, 1 additional substrate ablation (INRT) was conducted.

Atrial flutter

Typical AFL (T-AFL) and atypical AFL (A-AFL) was the second most ablated substrate during 2023, after AFib ablation. In total, there were 205 procedures made, 23% of the total. Isthmus-dependent T-AFL with counterclockwise conduction (CCW T-AFL) was the most frequent variant, with 70% (144/205), and next typical AFL with clockwise rotation (CW T-AFL) 18% (37/207) *(Figure 8).* RF was the most used energy in 100% of cases; 95% of ablations were the first procedure. The conventional ablation technique was used in 77% (158/205), in the remaining 23% non-fluo-



FIGURE 10

Percentages of success of procedures per type of atrial fibrillation, technique and year

AFib: atrial fibrillation; **PAF:** paroxysmal atrial fibrillation; **PsAF:** persistent atrial fibrillation; **LSPAF:** long-standing persistent atrial fibrillation; **RF:** radiofrequency; **CRYO:** cryoablation.



FIGURE 11

Percentages of complications of procedures per type of atrial fibrillation, technique and year

AFib: atrial fibrillation; **PAF:** paroxysmal atrial fibrillation; **PsAF:** persistent atrial fibrillation; **LSPAF:** long-standing persistent atrial fibrillation; **RF:** radiofrequency; **CRYO:** cryoablation.

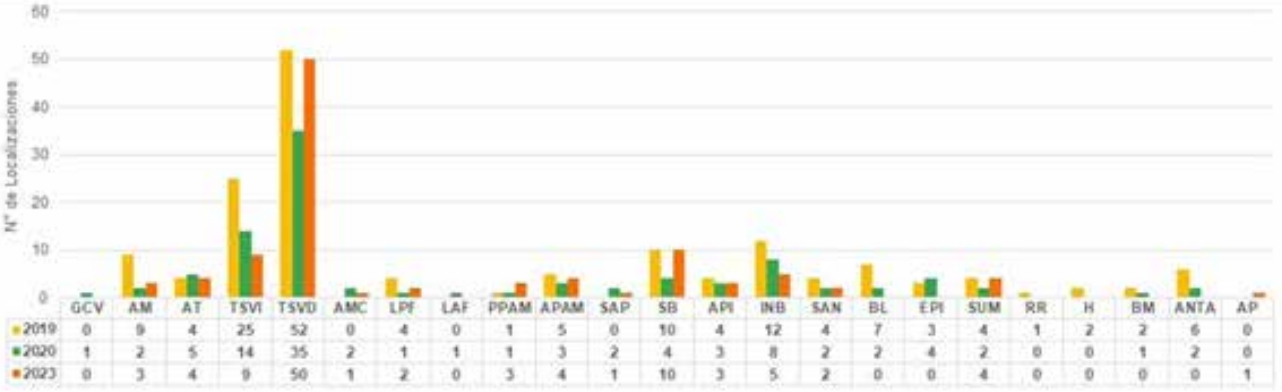


FIGURE 12

Distribution of ventricular substrates treated during the 2019/2020 and the 2020 registries

GCV: great cardiac vein; **MA:** mitral annulus; **TA:** tricuspid annulus; **LVOT:** left ventricular outflow tract; **RVOT:** right ventricular outflow tract; **AMC:** aortomitral continuity; **LPF:** left posterior fascicle; **LAF:** left anterior fascicle; **PMPM:** postero-medial papillary muscle; **ALPM:** anterolateral papillary muscle; **SAP:** septoapical; **BS:** basal septal; **ANS:** anterior septal; **API:** apical; **INB:** inferobasal; **ANTA:** anteroapical; **EPI:** epicardial; **SUM:** summit; **B-B:** branch-to-branch; **MB:** moderator band; **H:** His bundle; **PA:** pulmonary artery.

roscopic mapping systems (23 CCW T-AFL and 24 T-AFL). Access to left chambers (macro-reentrant atypical atrial flutter in left atrium) was made through transseptal access in 100% (14/14) of cases.

The most used catheters were non-irrigated with 70.73% (145/205). Contact force-sensing was only used in 8% (16/205) of procedures.

In 26 ablations, echocardiography was used as guide (5 peripheral venous contrast, 14 intracardiac and 7 TEE).

The global success of this procedure was 98% (97% in 2019 and 93.5% in 2020). The rate of complications was 2.9% (2.7% in 2019-2020) and corresponded to 2 hematomas, 2 pseudoaneurysms and 2 conduction disorders. In 11 patients, ablation of additional substrates (4 INRT, 5 AFib, 1 AVN and 1 FAT) was conducted.

Atrial fibrillation

AFib ablation was the most frequent procedure during 2023, with a total of 242 procedures, representing 27% of ablations; 52.63% (10/19) of centers carried out ablation of this substrate. The clinical presentation was paroxysmal (PAF) in 71% (171/242) of cases, persistent (PsAF) in 27% (66/242) and long-standing persistent (LSPAF) in the remaining 2% (5/242) *(Figure 9)*. The most used energy was RF with 59% (142/242), and second, cryoablation with 41% (100/242). Cryoablation was applied in 93 patients with PAF and in 7 with PsAF. In 100% of the procedures made with RF, non-fluoroscopic mapping systems and irrigated catheters were used, with 65% being with sensing and 35% with no contact force-sensing. Access to the left chambers was transseptal in all cases. Peripheral vascular echocardiogram was used in 22% (53/242), intracardiac echocardiography in 43% (104/242) and TEE in 7% (17/242); 94% (228/242) were first procedure, only 14 reablations were recorded. Pulmonary vein isolation was carried out in 96.69% (234/242) of cases. In 16% (38/242), additional applications

were conducted (16 posterior box, 2 roofline, 9 fractionated potentials, 6 superior vena cava 2 vein of Marshall).

The global success of AFib ablation was 98.3%; in *Figure 10* the percentage of success of the procedure is shown, according to technique, type of AFib and year. The global rate of complications in AFib ablation was 2.7%; an improvement in regard to the previous registry. In *Figure 11,* the percentage of complications of the procedure is shown according to technique, type of AFib and year. In 30 patients, additional ablations were made of AFL, 1 FAT, 1 INRT and 1 AV.

Ventricular arrhythmias

The VA ablation procedures during 2023 represented 11% (97/894) of cases; 52.63% (10/19) of centers conducted ablation of this substrate. VA were subdivided into 4 groups to facilitate analysis: premature ventricular contractions (PVC), non-sustained ventricular tachycardia (NSVT), sustained ventricular tachycardia (SVT) and arrhythmic storm (AS); 70% (68/97) of procedures corresponded to PVC, and second, SVT with 24% (23/97). Four patients presented AS; 72.2% (70/98) of patients did not present structural disease, 19.6% (19/98) ischemic heart disease, 4.1% (4/98) Chagas cardiomyopathy, 2.1% (2/98) congenital heart disease and 2.1% (2/98) arrhythmogenic cardiomyopathy.

The ablated locations were: great cardiac vein 0% (0/102), mitral annulus 2.9% (3/102), tricuspid annulus 3.9 (5/102), LV outflow tract 8.8% (9/102), RV outflow tract 49% (49/102), aortomitral continuity 1% (1/102), left posterior fascicle 2% (2/102), left anterior fascicle 0% (0/102), postero-medial PAM 2.9% (3/102), antero-lateral PAM 3.9% (4/102), septoapical 1% (1/102), septobasal 9.8% (10/102), anterior septal 2% (2/97), apical 2.9% (3/102), inferobasal (4.9%) (5/102), anteroapical 0% (0/102), lateral basal 0% (0/102), pulmonary artery 1% (1/102), epicardial 0% (0/102), summit 3.9% (4/102), His bundle 0% (0/102), moderator band 0% (0/102), branch-to-branch 0% (0/102) *(Figure 12).* Four centers made applications in 2 foci (3 patients with ischemic heart disease and 1 without heart disease), and 1 center in 3 foci (patients with congenital heart disease).

In just 2 patients with RVOT PVC and no structural heart disease, conventional ablation was carried out. In the remaining 97.9% of patients, ablation guided by non-fluoroscopic mapping was made. The total of ablations was made with RF. IV access was used in 100% of patients, and access to the left chambers was made by transseptal access in 14.4% (14/97) and retrograde aortic access in 27.8% (27/98). Just one patient required epicardial access.

The most widely used catheters were irrigated ones, in 88% (85/97), 59% (57/97) had contact force-sensing. In 37 patients, intracardiac echocardiography was used to guide the procedure, and TEE and peripheral venous contrast echocardiography were used just in 1.

The global success of the AV ablation procedures was 88.65% (86/97); an improvement in regard to the previous registry. The success of the RVOT procedure was 91.83% and of LVOT 88.88% *(Figure 13).* Complications (cardiac tamponade/perforation) were present in 2.1% (2/97) of patients, 1 in RVOT ablation and another in LVOT ablation *(Figure 14).* No additional substrate ablations were made.

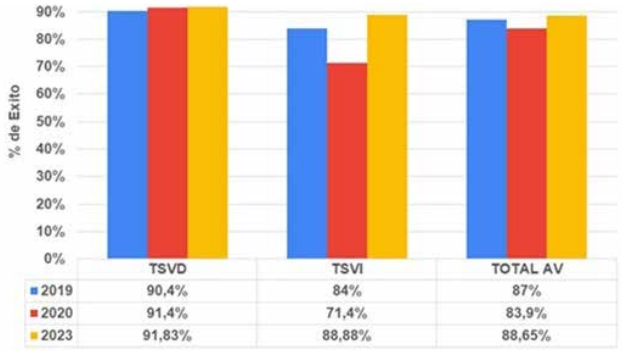


FIGURE 13
Percentages of success of the procedures of the total of ventricular arrhythmias and of RVOT and LVOT
RVOT: right ventricular outflow tract; **LVOT:** left ventricular outflow tract; **VA:** ventricular arrhythmias.

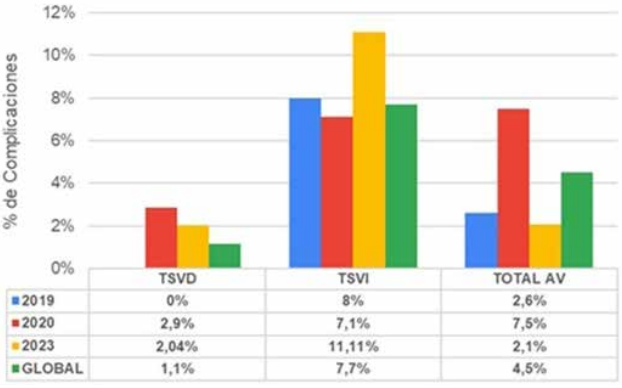


FIGURE 14
Percentages of complications of the procedures of the total of ventricular arrhythmias and of the RVOT and LVOT
RVOT: right ventricular outflow tract; **LVOT:** left ventricular outflow tract; **VA:** ventricular arrhythmias.

DISCUSSION

In spite of having facilitated the load of cases by an online form with any device, leaving behind the so criticized previous system, there is still low involvement. This year, just as with the previous one, no written or verbal commitment was required for data upload. In recent times, communication through the different academic meetings between electrophysiologists belonging to the three societies has brought us closer. This support between colleagues allowed us to determine the significance and need to have our own data, reflecting the reality of Argentina. Despite what was mentioned above, the absence of many centers and groups is noticeable in these registries. This leads to redouble our efforts, so that national registries may have increasingly more participants and to be more representative.

ANNEX 1
List of participating centers

CITY	CENTER	PERSON IN CHARGE OF DATABASE	CHIEF OF SERVICE
La Plata	Hospital Interzonal General de Agudos San Martin	Monjes Enrique	Camerini Daniel
La Plata	Instituto Medico Platense	Monjes Enrique	Zabala Federico
Gran Buenos Aires	Hospital Interzonal General de Agudos Presidente Perón	Jurado Juan Carlos	Delgado Lorena
La Plata	Instituto del Diagnostico S.A	Monjes Enrique	Medesani Luis
CABA	Clinica Adventista Belgrano	Jurado Juan Carlos	Lopez Cabanillas Nestor
Gran Buenos Aires	Sanatorio Bernal	Jurado Juan Carlos	Delgado Lorena
Posadas	Instituto de Cardiología y Cirugía Cardiovascular	Moreno Gerardo	Moreno Gerardo
Corrientes	Instituto de Cardiología de Corrientes	Reyes Gabriela	Pozzer Domingo Luis
CABA	Clínica Santa Isabel	Jurado Juan Carlos	Elencwajg Benjamín
CABA	Hospital Britanico de Buenos Aires	Iván Tello Santacruz	César Cáceres Monié
CABA	Hospital Churruca-Visca	Guzmán Juan Pablo	Díaz Uberti Pedro
Rosario	Instituto Cardiovascular de Rosario	Bravino Maria Florencia	Silvano Diangelo
Rosario	Hospital Privado de Rosario	Velasco Diego	Velasco Diego
Rosario	Hospital Centenario	Nannini Sebastian	Pellizzón Oscar
San Nicolas de los Arroyos	Fundación Nuestra Señora del Rosario	Trotta Omar	Telechea Trentin Juan
San Rafael	Hospital Español del Sur Mendocino - Incorsa	Cozzari Jennifer	Cozzari Jennifer
Córdoba	Instituto Oulton	Arabia Luis	Arabia Luis
General Roca	Sanatorio Juan XXII	Taquichiri Acuña Noemi	Raña Ramón

In this new edition of the catheter ablation registry, it was possible to observe that just as in others, participation by centers fluctuates.[3] The presence of new centers was observed and the absence of others that had participated previously. There were centers that registered to it but did not upload cases. These centers were not included in the final report.

The relationship between centers financing, public or private, remained in favor of the latter, as in the previous registry. In this edition, there was a higher number of centers with 3D navigators; the rate of centers without this technology decreased from 22.2% to 10.5% in comparison to the previous registry. On the other hand, cryoablation availability increased in centers from 12.5% to 47.36%.

It is remarkable that a lower number of centers declares having intracardiac echocardiography available (61.11% vs 31.5% in the current report).

From 83.33% of centers that had support cardiovascular surgery available, now 94.7% have it.

Month by month, except for January 2020, a greater number of procedures were carried out in 2023 in comparison to that year. However, 2023 had a lower number of procedures in comparison with 2019, showing the impact of the pandemic and the national context that are still influencing this practice.

In AVNRT ablation, it is possible to observe a partial return to the classically used technique. The approach, although depending on the access location, the experience of the operator, the availability of the necessary extra material, among other variables, experienced an increase in re-

trograde aortic access from 9.64% reported in the previous registry (2019-2020) to 62.19% in 2023.

In AFL, an increase was observed in the ablation of atypical flutters, that went from 6.17% to 18%; just as with the rate of use of navigators, that increased from 17.55% to 23%. Although low, an increase was observed in the use of contact force-sensing catheters, from 2.97% to 8%.

AFib ablation deserves special attention, as it reaches 3.6% of ablations in the 2007-2009 registry, and 15.51% in the previous registry (2019-2020), to becoming the most intervened substrate in 2023, with 27% of ablations, replacing AFL in the first place.[1,2] In 2023, there were 242 procedures made of AFib ablation, exceeding both 2020 (106) and 2019 (152). Cryoablation is being more used in this substrate, going from 18.2% in the previous registry to 38.42%. Also, a mild decrease was observed in the rate of success, being 99.3% in 2019, 100% in 2020, and 98.3% in 2023. An increase in AFib ablation procedures was observed in all its presentations; however, a predominance was observed in the PsAF and LSPAF forms. An increase was verified in AFib ablation by radiofrequency of 1.23 times in its paroxysmal presentation, 2.36 times in PsAF and 2.5 times in LSPAF. In cryoablation, there was a 5.81 increase in PAF; while only 7 procedures for PsAF were carried out in 2023 in comparison with none in 2020.

Ventricular arrhythmias are perhaps one of the substrates where we are farthest from reaching the number of cases reported before the pandemic. There were 93 procedures made (11% of the total) in the current registry, the same number as in 2020, in comparison with 154 in 2019 (14.44%). Navigator use went from being used in 70.85% to 97.9%. A small improvement was observed in global success, with 88.65% in the current registry vs 85.8% (2019-2020).

From the complications observed in this registry, although a few, a greater number was reported in 2019 and 2020. The presence of pseudoaneurysms in procedures with exclusive venous access requires proposing strategies that would make vascular access safer, such as using peripheral venous contrast echocardiogram. This technique was used in 9.6% of AVNRT ablation procedures and in 2.43% of AFL.

CONCLUSIONS

An adequate and growing rate of global and immediate success was observed. It was 94.71% in the previous registry and 96% in 2023. Both the rate of global success and the rates in the different substrates are similar to international multicenter reports. Except for atrial tachycardia, an increase was observed in the number of procedures in all substrates in 2023 in comparison with 2020. The substrate that increased the most was atrial fibrillation, which grew 2.28 times in regard to the number of procedures in 2020, with a higher addition in the persistent and long-standing persistent forms.

This registry made in 19 centers in Argentina about catheter ablation displays significant information, whose usefulness is not just in the figures of procedures and substrates, but also in the dynamic changes occurring with the addition of techniques and technologies, but not exempt from receiving the influence of the social and financial problems of the country. About this, for 2023, we can infer that we were on our way to reaching the number of procedures previous to the pandemic. The systematic continuity of carrying out this survey with future registries is essential to assess the results and the direction of work in catheter ablation of arrhythmias.

BIBLIOGRAPHY

1. Trotta O, Tello Santacruz I, Valentino M, et al. Registro Multicéntrico de Ablación con catéter en Argentina. Rev Fed Arg Cardiol **2023**; 52: 147 – 155.
2. Gant Lopez J, Labadet C, González JL, et al. Primer Registro Argentino De Ablación Con Catéter. Rev Argent Cardiol **2011**; 79: 117 - 124.
3. Anguera I, Cano Pérez Ó, Bazán V; Spanish catheter ablation registry collaborators. Spanish catheter ablation registry. 21st official report of the Heart Rhythm Association of the Spanish Society of Cardiology (2021). Rev Esp Cardiol (Engl Ed) **2022**; 75: 1029 -1039.
4. Rojel Martinez U, Llorente J, López Cabanillas N, et al; "II LAHRS EP Registry" investigators. The second Latin American catheter ablation registry ("II LAHRS EP registry"). J Interv Card Electrophysiol **2024**. doi: 10.1007/s10840-024-01942-4.