Heart Rhythm Society Annual Scientific Sessions April 2026 Chicago

Future Role of Robotics and Automation: The Hospital and the ASC

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Cardiac Arrhythmia Group

On that day
the world was changed forever...

January 1st, 2026

In 2026, 13 Codes Related to EP Procedural Offerings Added to ASC-CPL

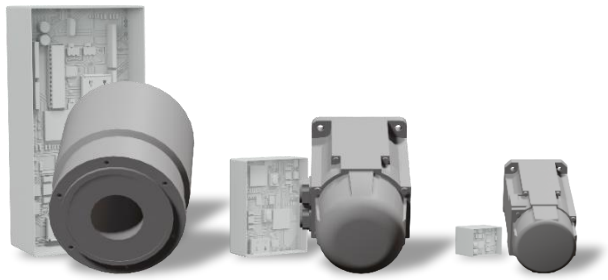
	Procedure Description	Payment Indicator	Code	2026 Reimbursement
1	Cardioversion, elective, electrical conversion of arrhythmia; External	G2	92960	$364
2	Cardioversion electric electrical conversion of arrhythmia; Internal	G2	92961	$364
3	Echocardiography, transesophageal, real-time with image documentation (2D) (with or without M-mode recording); including probe placement, image acquisition, interpretation and report	Z3	93312	$134
4	Echocardiography, transesophageal (TEE) for monitoring purposes, including probe placement, real time 2-dimensional image acquisition and interpretation leading to ongoing (continuous) assessment of (dynamically changing) cardiac pumping function and to therapeutic measures on an immediate time basis	Z2	93318	$297
5	Comprehensive electrophysiologic evaluation with right atrial pacing and recording, right ventricular pacing and recording, His bundle recording, including insertion and repositioning of multiple electrode catheters, without induction or attempted induction of arrhythmia	Z2	93619	$4,149
6	Comprehensive electrophysiologic evaluation including insertion and repositioning of multiple electrode catheters with induction or attempted induction of arrhythmia; with right atrial pacing and recording, right ventricular pacing and recording, His bundle recording	Z2	93620	$4,149
7	Electrophysiologic evaluation of single or dual chamber transvenous pacing cardioverter-defibrillator (includes defibrillation threshold evaluation, induction of arrhythmia, evaluation of sensing and pacing for arrhythmia termination, and programming or reprogramming of sensing or therapeutic parameters)	Z3	93642	$83

Cont., 13 Codes Related EP Procedural Offerings Added to ASC-CPL

	Procedure Description	Status Indicator	Code	2026 Reimbursement
8	Intracardiac catheter ablation of **atrioventricular node function**, atrioventricular conduction for creation of completer heart block, with or without temporary pacemaker placement	J8	93650	$5,943
9	Comprehensive electrophysiologic evaluation including insertion and repositioning of multiple electrode catheters with induction or attempted induction of an arrhythmia with right atrial pacing and recording, right ventricular pacing and recording (when necessary) and His bundle recording (when necessary) with intracardiac catheter ablation of arrhythmogenic focus; with treatment of **supraventricular tachycardia** by ablation of fast or slow atrioventricular pathway, accessory atrioventricular connection, cavo tricuspid isthmus or other single atrial focus or source of atrial re-entry	J8	93653	$19,176
10	Comprehensive electrophysiologic evaluation including insertion and repositioning of multiple electrode catheters with induction or attempted induction of an arrhythmia with right atrial pacing and recording, right ventricular pacing and recording (when necessary) and His bundle recording (when necessary) with intracardiac catheter ablation of arrhythmogenic focus; with treatment of **ventricular tachycardia or focus of ventricular ectopy** including intracardiac electrophysiologic 3D mapping, when performed, and left ventricular pacing and recording, when performed	J8	93654	$19,482
11	Intracardiac catheter ablation of a discrete mechanism of arrhythmia which is distinct from the primary ablated mechanism, including repeat diagnostic maneuvers, to treat a **spontaneous or induced arrhythmia (List separately in addition to code for primary procedure)**	N1	+93655	n/a
12	Comprehensive electrophysiologic evaluation with transseptal catheterizations, insertion and repositioning of multiple electrode catheters, induction or attempted induction of an arrhythmia including left or right atrial pacing/recording, and intracardiac catheter ablation of **atrial fibrillation by pulmonary vein isolation**, including intracardiac electrophysiologic 3 dimensional mapping, intracardiac echocardiography with imaging supervision and interpretation, right ventricular pacing/recording, and His bundle recording, when performed	J8	93656	$20,256
13	Additional linear or focal intracardiac catheter ablation of the left or right atrium for treatment of **atrial fibrillation remaining after completion of pulmonary vein isolation (List separately in addition to code for primary procedure)**	N1	+93657	n/a

GENESIS X

2003
MINIATURIZED ELECTRONICS



2020
DOWNSIZED CABINETS

2025
SMALLER CABLES

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GENESISX
cnsystems
BP
NBP
SVR
CIRCA Scientific, Inc.
Society
STEREOTAXI

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Robotics in the ASC??? Really?

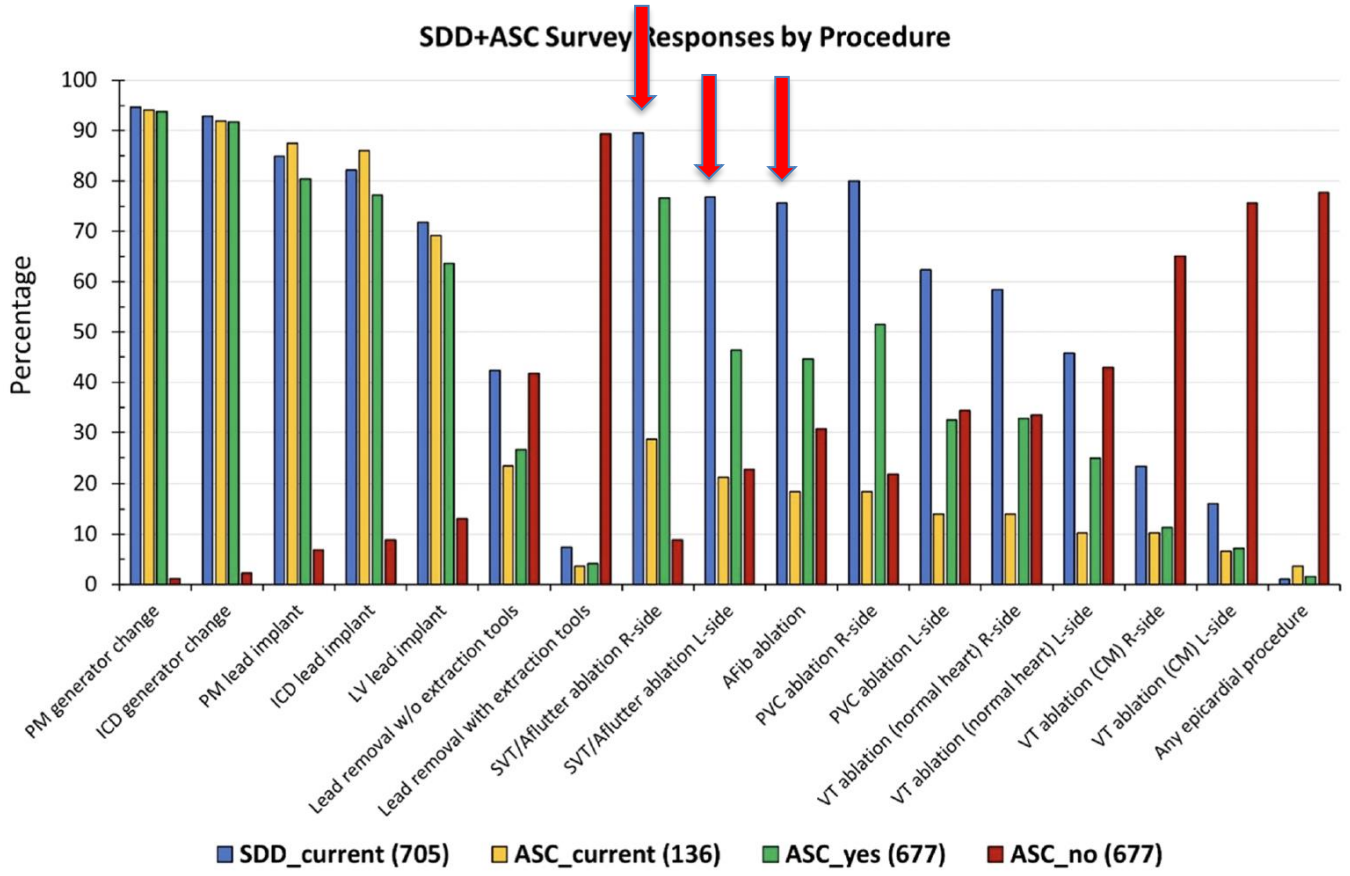
- Too expensive? Capital outlay?
- Retrofit? Shielding, space considerations
- Disposables limited, expensive?
- Esoteric cases, not bread and butter?

Robotics in the ASC??? Really.

- Value proposition ***today***
  - Safety
  - Standardization
  - Margins: less, not more catheters
  - Throughfare/effiency
- Value proposition ***tomorrow***
  - Automation

What does the ASC need? What cases?

Heart Rhythm, Vol 23, No 1, January 2026



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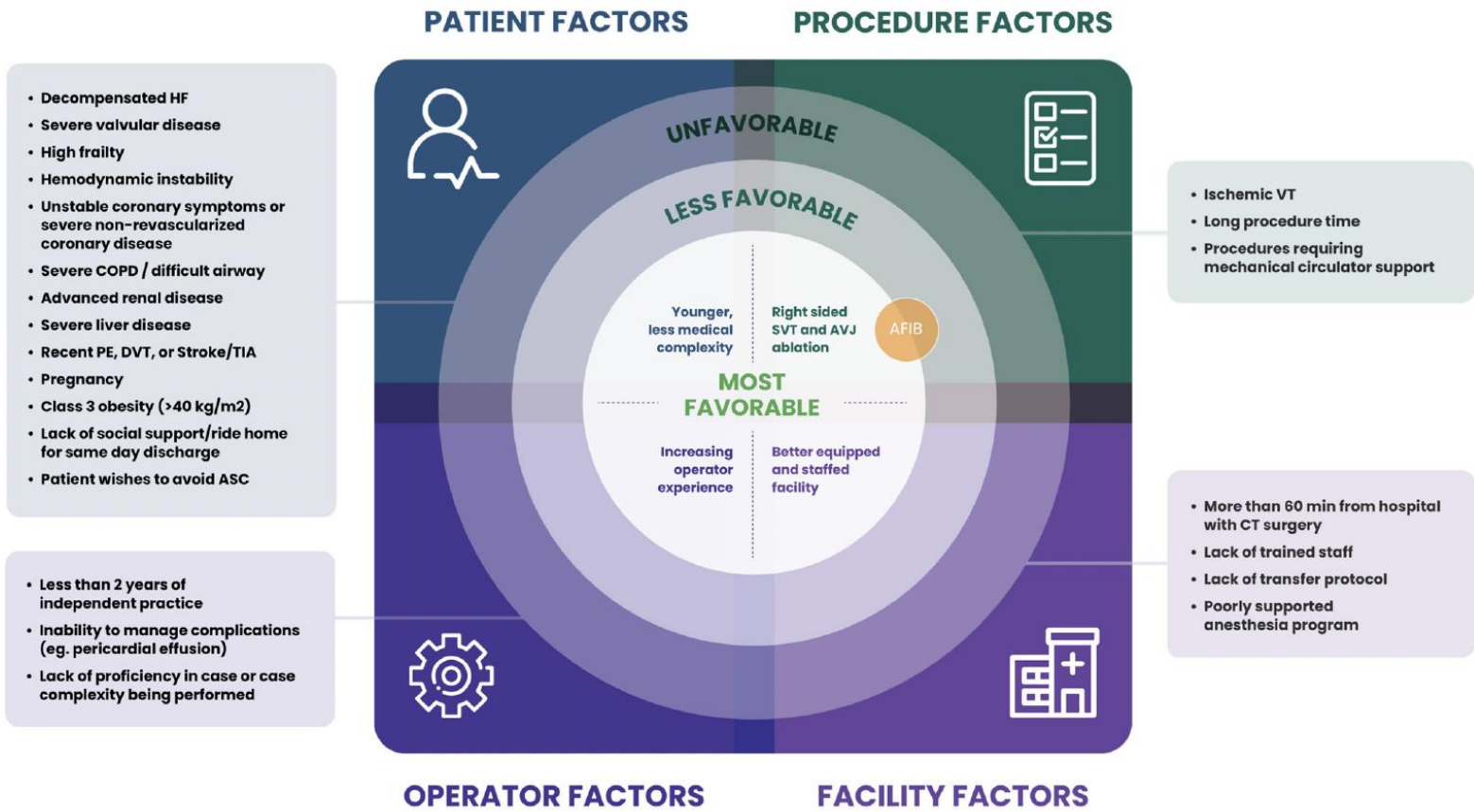
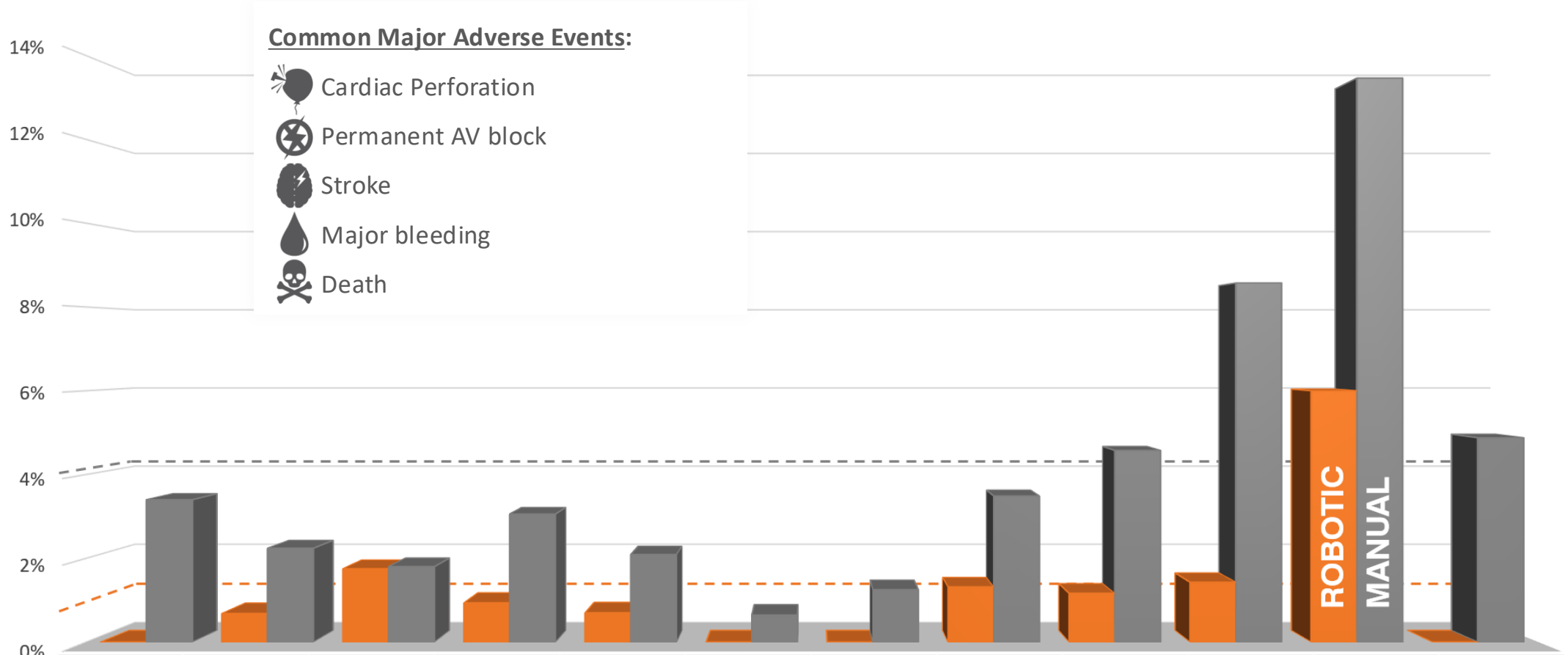

PATIENT FACTORS
PROCEDURE FACTORS
• Decompensated HF
• Severe valvular disease
• High frailty
• Hemodynamic instability
• Unstable coronary symptoms or severe non-revascularized coronary disease
• Severe COPD / difficult airway
• Advanced renal disease
• Severe liver disease
• Recent PE, DVT, or Stroke/TIA
• Pregnancy
• Class 3 obesity (>40 kg/m2)
• Lack of social support/ride home for same day discharge
• Patient wishes to avoid ASC
UNFAVORABLE
LESS FAVORABLE
Younger, less medical complexity
Right sided SVT and AVJ ablation
AFIB
MOST FAVORABLE
Increasing operator experience
Better equipped and staffed facility
• Ischemic VT
• Long procedure time
• Procedures requiring mechanical circulator support
• Less than 2 years of independent practice
• Inability to manage complications (eg. pericardial effusion)
• Lack of proficiency in case or case complexity being performed
• More than 60 min from hospital with CT surgery
• Lack of trained staff
• Lack of transfer protocol
• Poorly supported anesthesia program
OPERATOR FACTORS
FACILITY FACTORS

Safety



Qiu, et al.[17] 2018	Yuan, et al.[15] 2017	Kataria, et al.[16] 2017	Lim, et al.[14] 2017	Adragão, et al.[11] 2016	Weiss, et al.[10] 2016	Di Biase, et al.[9] 2015	Akca, et al.[8] 2015	Hendriks, et al.[7] 2015	Koutalas, et al.[6] 2015	Dinov, et al.[3] 2012	Szili-Torok, et al.[1] 2012
n=152	214	336	443	574	627	218	1,517	239	140	102	113
PVC	AF	AF	AF	AF	AF	VT	AF, SVT, VT	VT	AF	VT	VT

Major adverse event rates comparing RMN (orange) vs. manual navigation (gray) in head-to-head publications of >50 patients from 2012-2019. Studies which did not report data for major adverse events[4, 5] or reported no major adverse events in either group[2, 12, 13, 18] were excluded.

AF=Atrial Fibrillation, PVC=Premature Ventricular Contraction, SVT=Supraventricular Tachycardia, VT=Ventricular Tachycardia

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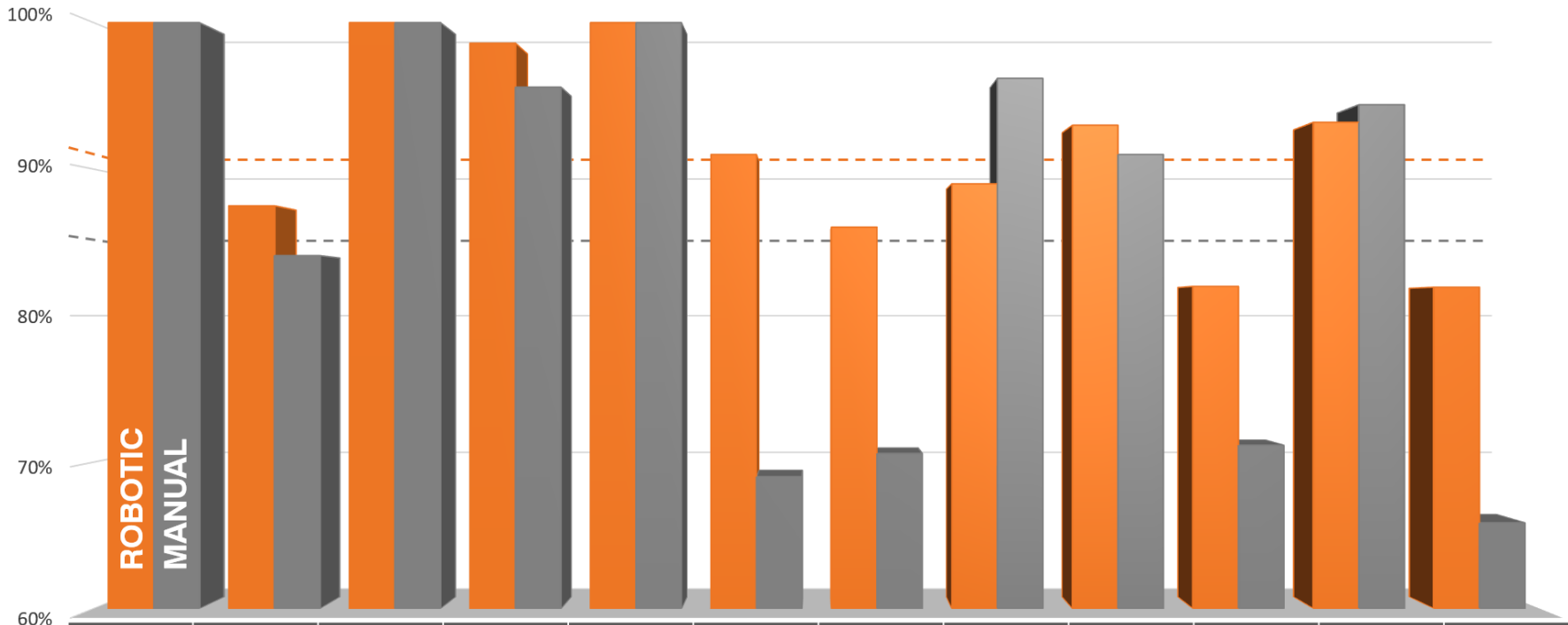
Acute Efficacy: can lead to standardization

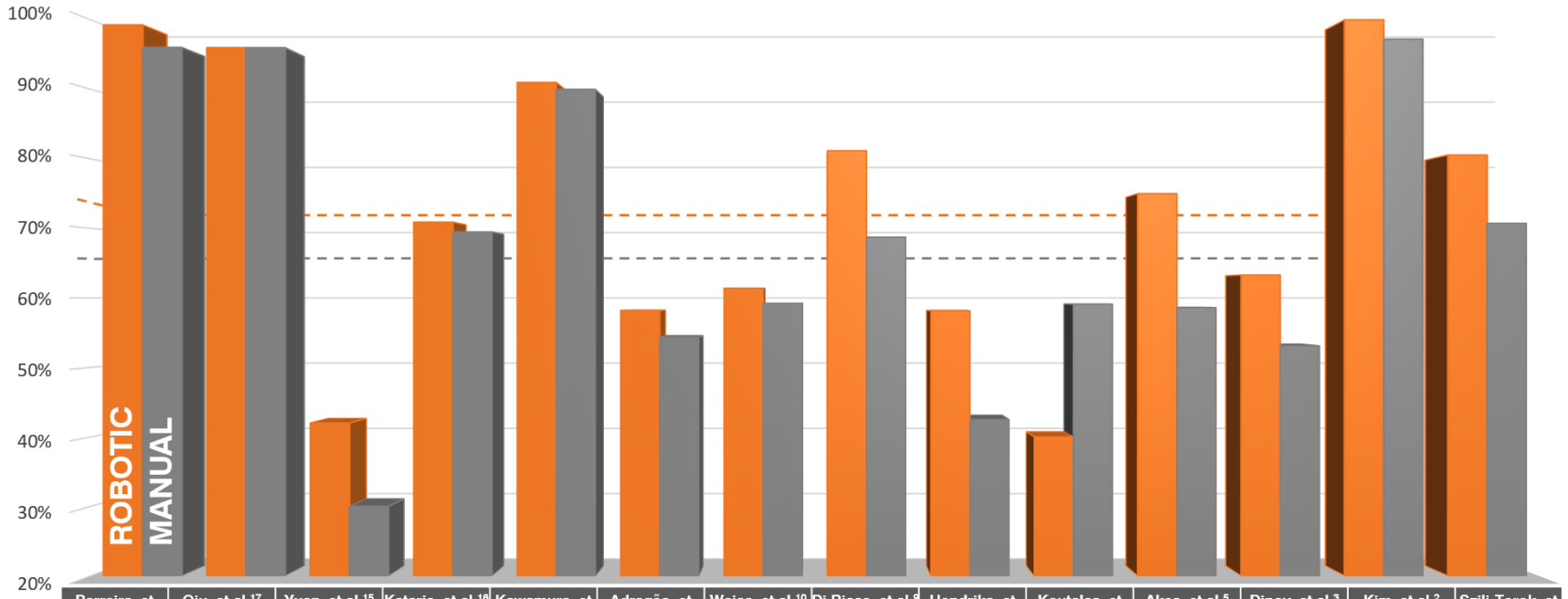


Parreira, et al.[18] 2019	Qiu, et al.[17] 2018	Kataria, et al.[16] 2017	Lim, et al.[14] 2017	Reents, et al.[13] 2017	Kawamura, et al.[12] 2017	Hendriks, et al.[7] 2015	Akca, et al.[5] 2013	Roudijk, et al.[4] 2013	Dinov, et al.[3] 2012	Kim, et al.[2] 2012	Szili-Torok, et al.[1] 2012
n=240	152	336	443	218	51	239	163	62	102	145	113
SVT	PVC	AF	AF	SVT	VT	VT	AF, SVT, VT	SVT	VT	AP	VT

Acute success rates comparing RMN (orange) vs. manual navigation (gray) in head-to-head publications of >50 patients from 2012-2019. Studies which did not report acute success data were excluded.[6, 8, 9, 10, 11, 15]

AF=Atrial Fibrillation, AP= Accessory Pathway-Mediated Tachycardia, PVC=Premature Ventricular Contraction, SVT=Supraventricular Tachycardia, VT=Ventricular Tachycardia

Long Term Efficacy: can lead to standardization



Parreira, et al.[18] 2019	Qiu, et al.[17] 2018	Yuan, et al.[15] 2017	Kataria, et al.[16] 2017	Kawamura, et al.[12] 2017	Adragão, et al.[11] 2016	Weiss, et al.[10] 2016	Di Biase, et al.[9] 2015	Hendriks, et al.[7] 2015	Koutalas, et al.[6] 2015	Akca, et al.[5] 2013	Dinov, et al.[3] 2012	Kim, et al.[2] 2012	Szili-Torok, et al.[1] 2012
n=240	152	214	336	51	574	627	218	239	140	163	102	145	113
SVT	PVC	AF	AF	VT	AF	AF	VT	VT	AF	AF, SVT, VT	VT	AP	VT
1.4 Years	2.2	3.5	2.2	2.1	2.6	1.0	1.3	2.1	2.4	1.6	1.1	1.8	1.7

Freedom from recurrence rates comparing RMN (orange) vs. manual navigation (gray) in head-to-head publications of >50 patients from 2012-2019 with follow-up greater than or equal to one year.
Studies which reported follow-up of less than one year[4, 13] or did not report freedom from recurrence data[7, 8, 14] were excluded.
AF=Atrial Fibrillation, AP= Accessory Pathway-Mediated Tachycardia, PVC=Premature Ventricular Contraction, SVT=Supraventricular Tachycardia, VT=Ventricular Tachycardia

Stereotaxis: Irrigated-tip

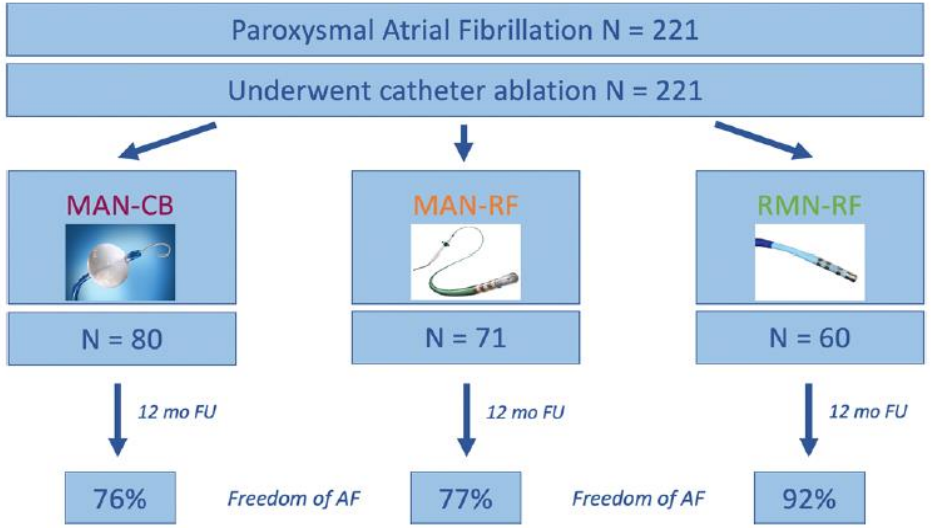
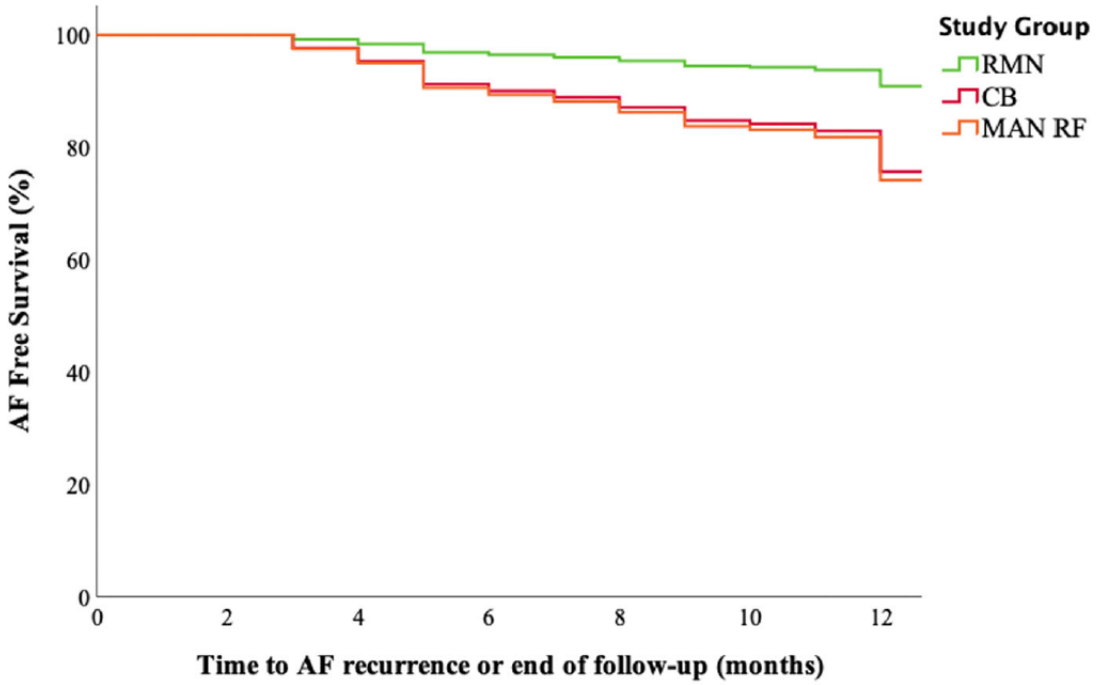


FIGURE 1 This prospective multicenter study investigated ablative therapy techniques as a treatment of paroxysmal atrial fibrillation (AF). This figure presents a schematical overview of the study population and distribution among the treatment groups. After 12 months of follow-up, there was an 81% freedom of AF in general, which was significantly higher in patients treated with robotic magnetic navigation-guided radiofrequency (RMN-RF). FU, follow-up; MAN-CB, manual-guided cryoballoon; MAN-RF, manual-guided radiofrequency.



MAN-CB	Nr at risk	80	79	77	74	71	68	51
	Cum Events	0	0	1	4	6	8	19
MAN-RF	NR at risk	71	69	64	59	58	53	42
	Cum events	0	0	3	8	9	13	16
RMN-RF	Nr at risk	60	59	58	55	54	51	50
	Cum events	0	0	0	3	4	5	5

Noten AME…Szilli-Torok T, J. Cardiovasc. Electrophysiol. 2023;34:2472–2483

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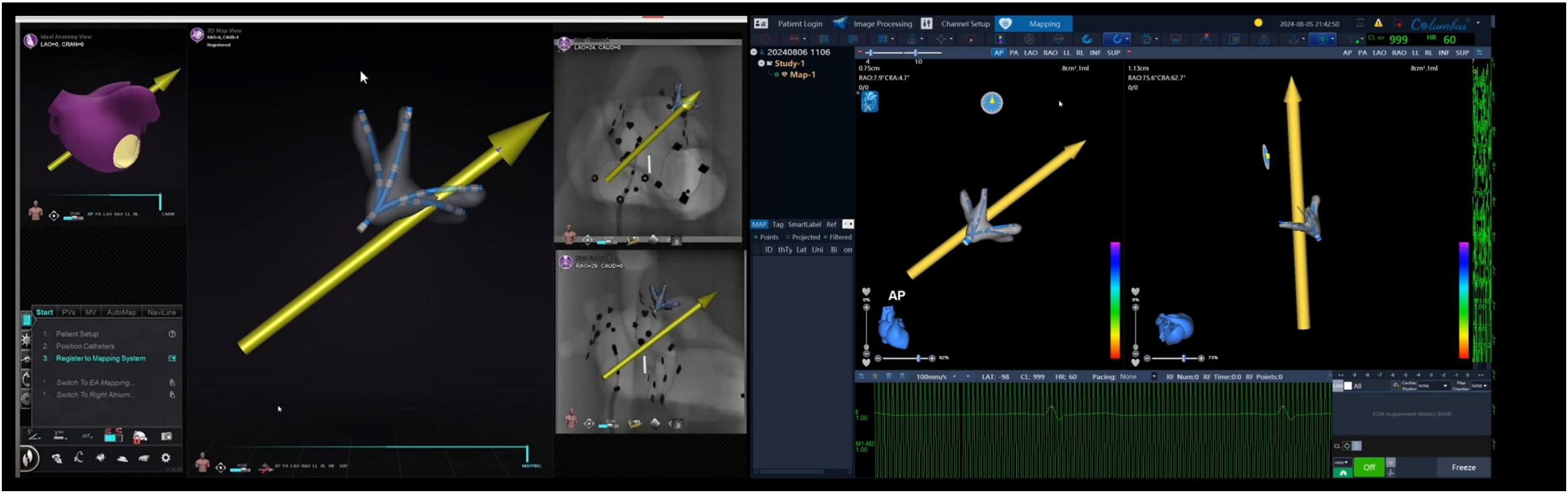
Columbus RMN Module



The model was constructed with EasyStars Magbot HD mapping catheter and the Magbot ablation catheter was used for ablation.

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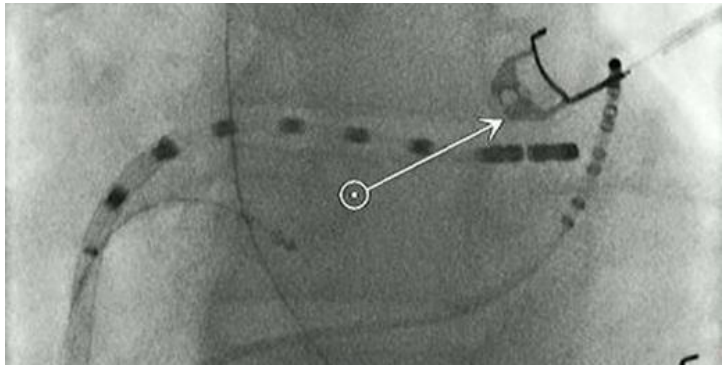
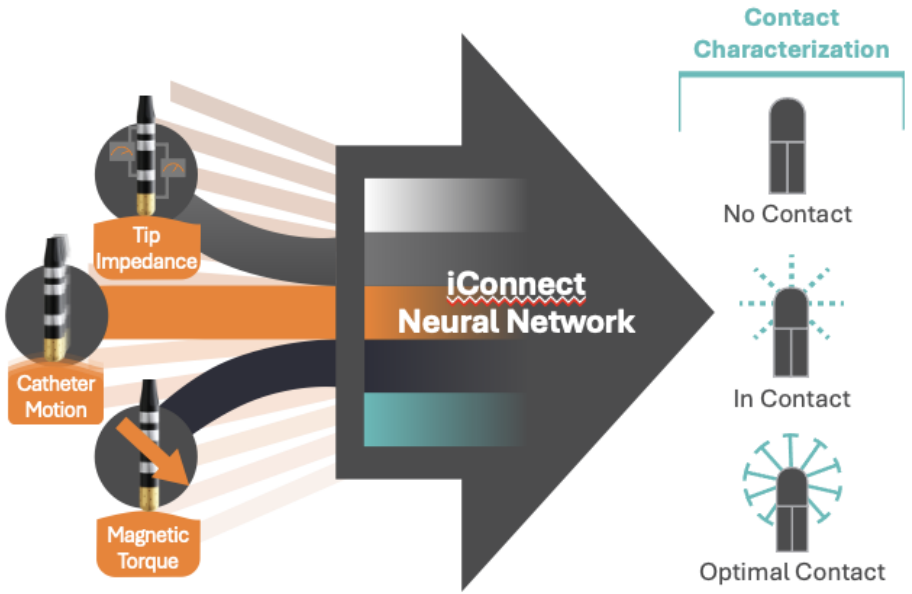
MAGiC™ Catheter

- Developed free of strategic partnership/control
- Modular Platform: Mapping system compatibity
- e-Contact Module
- Gold tip with Surround Flow
- 8 navigation magnets in shaft
- Tip with more than double magnetic material



Real Time Contact Indicator



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Increasing peer review literature cadence

J Interv Card Electrophysiol (2017) 48:237–245
DOI 10.1007/s10840-016-0217-3

MAGNETIC VT study: a prospective, multic randomized controlled trial comparing VT al using remote magnetic navigation-guided sul and ablation versus manual approach in a lo

Luigi Di Biase[1,2,3,4] · Roderick Tung[5] · Tamás Szili-Torok[6] · J. David Burkhard Peter Weiss[7] · Rene Tavernier[8] · Adam E. Berman[9] · Erik Wissner[10] · William Xu Chen[11] · Petr Neužil[12] · Jan Skoda[12] · Dhanunjaya Lakkireddy[13] · Bruno Schwagten[14] · Ken Lock[15] · Andrea Natale[1,3,16,17,18,19,20] · on behalf of MAGNETIC VT investigators

Received: 11 October 2016 / Accepted: 8 December 2016 / Published online: 7 January 2017

Abstract
Purpose Patients with ischemic cardiomyopathy (ICM) are prone to scar-related ventricular tachycardia (VT). The success of VT ablation depends on accurate arrhythmogenic substrate localization, followed by optimal delivery of energy provided by constant electrode-tissue contact. Current manual and remote magnetic navigation (RMN)-guided ablation strategies aim to identify a reentry circuit and to target a critical isthmus through activation and entrainment mapping during ongoing tachycardia. The MAGNETIC VT trial will assess if VT ablation using the Niobe™ ES magnetic navigation system

results in superior
subjects with ische
Methods and resu
spective, multicen
jects (193 per gro
between treatment
via a manual proce
will consist of pat
left ventricular ejec
able cardioverter
monomorphic VT

✉ Andrea Natale
dr.natale@gmail.com

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11 Department of Ca
12 Department of Ca Prague, Czech Re
13 University of Kar
14 ZNA Middelheim
15 Stereotaxis, Inc.,
16 California Pacific
17 Division of Cardi
18 Case Western Re
19 Scripps Clinic, Sa
20 Dell Medical Sch

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DOI: 10.1111/jce.14380

FELLOWS CORE CURRICULUM

Robotics for catheter ablation of cardiac arrhythm technologies and practical approaches

Guillaume Bassil MD | Steven M. Markowitz MD | Christopher F. L
George Thomas MD | James E. Ip | Bruce B. Lerman MD | Jim V

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Abstract
Robotic technology has emerged as an important tool t
of arrhythmias. Robotic cardiac electrophysiology t
magnetic navigation and manual robotic navigation. Rob
with respect to ease of catheter manipulation in anati
minimization of fluoroscopic exposure to both patients a
in operator fatigue. This review provides a compreh
electrophysiology technology, its practical applications a
targeting cardiac arrhythmias.

KEYWORDS
catheter ablation, remote magnetic navigation, robotics

1 | INTRODUCTION

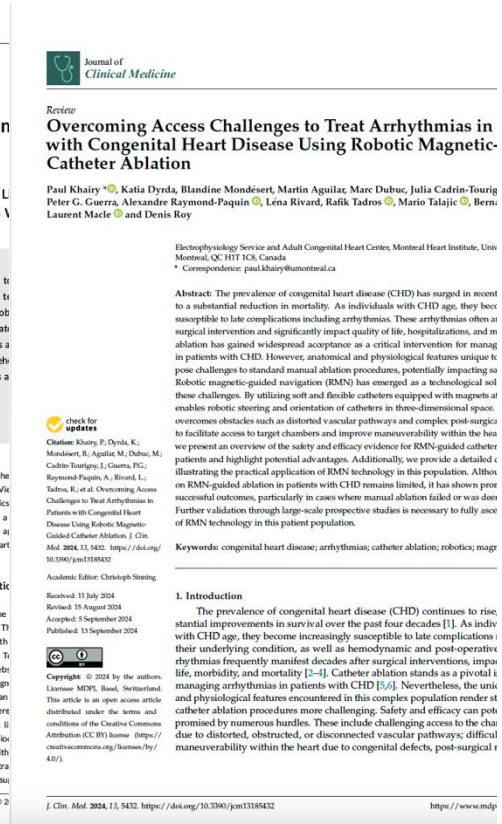
While the use of electroanatomic mapping systems and contact force sensing technology has facilitated catheter ablation procedures in recent years, manual navigation of ablation catheters to areas such as the left ventricular outflow tract via a transseptal approach, the pulmonary sinuses of the right ventricular outflow tract, and the left ventricular summit via the coronary venous system can be challenging. The use of robotic technology may offer several potential advantages such as reduced operator fatigue, enhanced catheter maneuverability to reach anatomically remote locations, increased catheter tip flexibility to reduce risk of perforation and minimization of fluoroscopy. This review provides an overview of robotic electrophysiology technology and its practical applications for catheter ablation as well as its safety and efficacy for treating cardiac arrhythmias.

2 | OVERVIEW OF ROBOTIC TECHNOLOGY IN CARDIAC ELECTROPHYSIOLOGY

Three different robotic systems have been developed for catheter ablation: the Niobe remote magnetic navigation (RMN) system (Stereotaxis Inc, St Louis, MO); the (Hansen Medical Inc, Mountain Vie catheter system (Catheter Robotics Sensei and AMIGO systems use a ulation, the Niobe system uses a navigate catheters within the heart

2.1 | Stereotaxis magnetic

Since its introduction in 2003, the as the most widely used system. T external magnets located on both generating a field of 0.08-0.1 T designed catheters (Biosense-Webs flexible tip containing three magn terized system, the catheter can vector application (Navigant, Stere advanced and retracted with as li robotic driver (Figure 1C) (Cardio system can fully integrated with anatomic mapping system. Registra the start of the case can allow su



Journal of Clinical Medicine

Review

Overcoming Access Challenges to Treat Arrhythmias in with Congenital Heart Disease Using Robotic Magnetic- Catheter Ablation

Paul Khairy *, Katia Dyrda, Blandine Mondésert, Martin Aguilar, Marc Dubuc, Julia Cadrin-Tourig Peter G. Guerra, Alexandre Raymond-Paquin, Léna Rivard, Rafik Tadros, Mario Talajic, Bern Laurent Macle and Denis Roy

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check for updates

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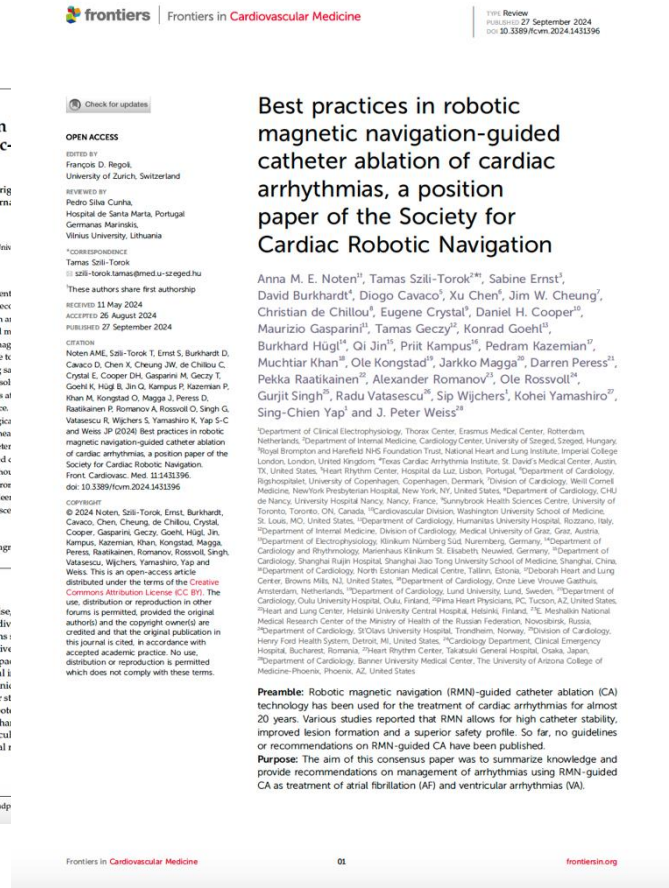
Abstract: The prevalence of congenital heart disease (CHD) has surged in recent to a substantial reduction in mortality. As individuals with CHD age, they becc susceptible to late complications including arrhythmias. These arrhythmias often a surgical intervention and significantly impact quality of life, hospitalizations, and m ablation has gained widespread acceptance as a critical intervention for manag in patients with CHD. However, anatomical and physiological features unique t pose challenges to standard manual ablation procedures, potentially impacting sa Robotic magnetic-guided navigation (RMN) has emerged as a technological sol these challenges. By utilizing soft and flexible catheters equipped with magnets al enables robotic steering and orientation of catheters in three-dimensional space. overcomes obstacles such as distorted vascular pathways and complex post-surgica to facilitate access to target chambers and improve maneuverability within the hea we present an overview of the safety and efficacy evidence for RMN-guided catheter patients and highlight potential advantages. Additionally, we provide a detailed illustrating the practical application of RMN technology in this population. Althou on RMN-guided ablation in patients with CHD remains limited, it has shown pror successful outcomes, particularly in cases where manual ablation failed or was deer Further validation through large-scale prospective studies is necessary to fully asce of RMN technology in this patient population.

Keywords: congenital heart disease; arrhythmias; catheter ablation; robotics; magr

1. Introduction

The prevalence of congenital heart disease (CHD) continues to rise, stantial improvements in survival over the past four decades [1]. As indiv with CHD age, they become increasingly susceptible to late complications their underlying condition, as well as hemodynamic and post-operative rhythmias frequently manifest decades after surgical interventions, impa life, morbidity, and mortality [2–4]. Catheter ablation stands as a pivotal managing arrhythmias in patients with CHD [5,6]. Nevertheless, the uni and physiological features encountered in this complex population render st catheter ablation procedures more challenging. Safety and efficacy can pot promised by numerous hurdles. These include challenging access to the cha due to distorted, obstructed, or disconnected vascular pathways; difficul maneuverability within the heart due to congenital defects, post-surgical



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Best practices in robotic magnetic navigation-guided catheter ablation of cardiac arrhythmias, a position paper of the Society for Cardiac Robotic Navigation

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Preamble: Robotic magnetic navigation (RMN)-guided catheter ablation (CA) technology has been used for the treatment of cardiac arrhythmias for almost 20 years. Various studies reported that RMN allows for high catheter stability, improved lesion formation and a superior safety profile. So far, no guidelines or recommendations on RMN-guided CA have been published.
Purpose: The aim of this consensus paper was to summarize knowledge and provide recommendations on management of arrhythmias using RMN-guided CA as treatment of atrial fibrillation (AF) and ventricular arrhythmias (VA).

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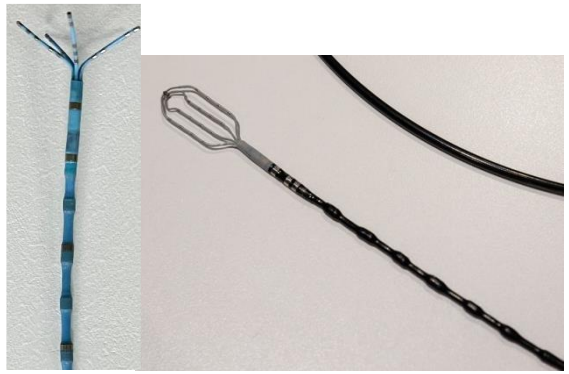
Cardiac Arrhythmia Group

New Robotic Tools in Development



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Back to the ASC needs…

- Robotics cost effective…
  - SVT: one ablation catheter, one CS catheter
  - AF: one ablation catheter, ICE, one mapping catheter
  - Integrated 3d mapping

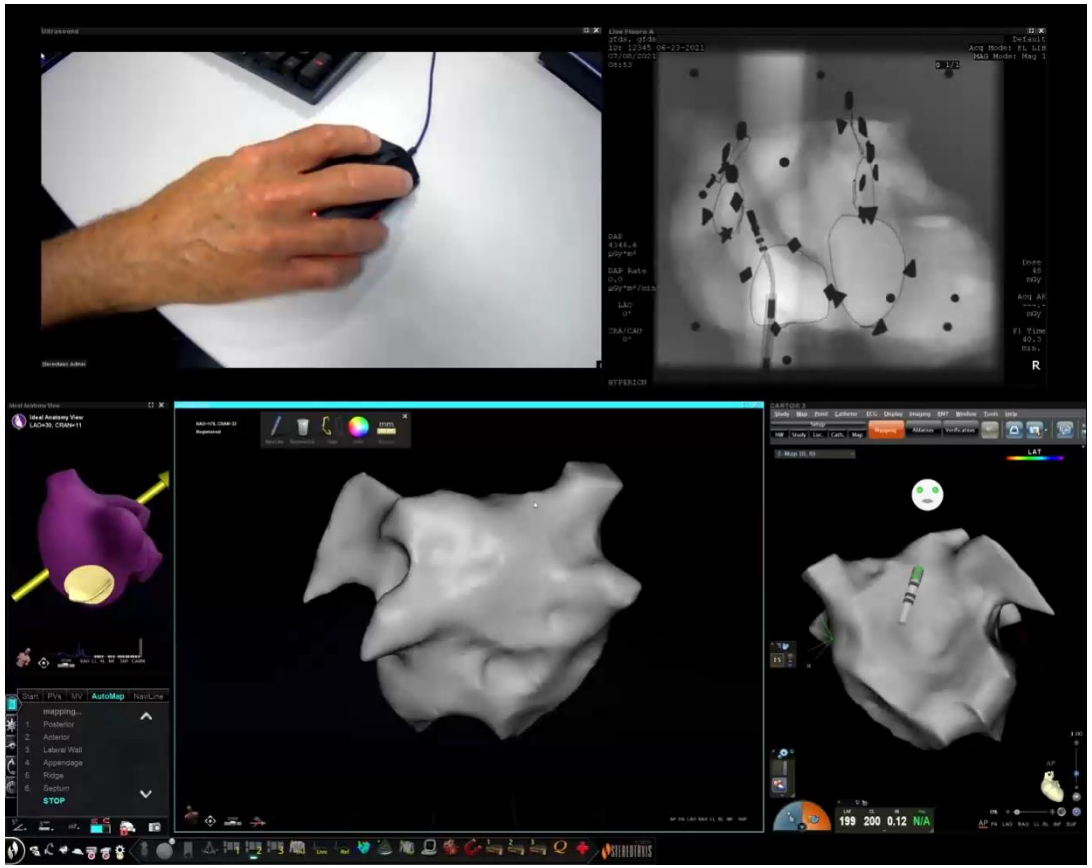
Efficiency/throughfare

- decreased safety concerns
- usual protocols for SVT/AF ablation

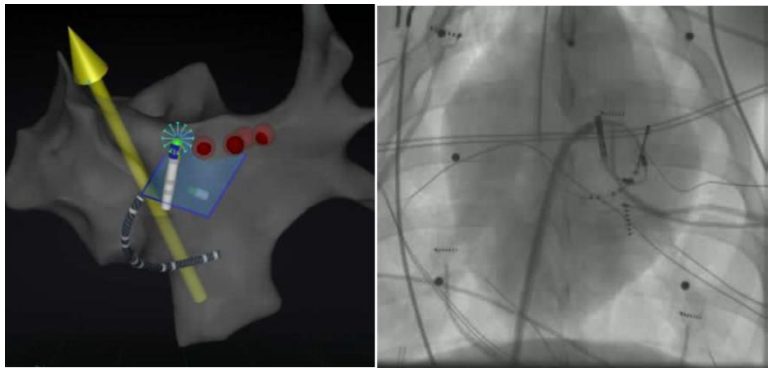
- or

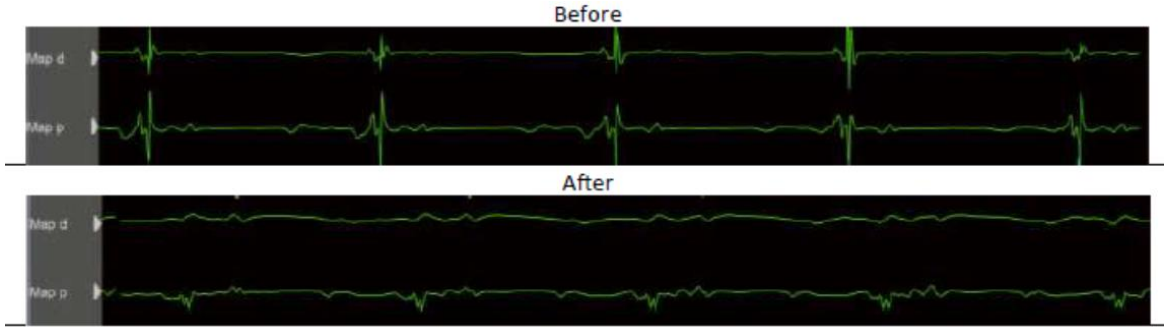
- ***ARM cases…***
  - ***right and left-sided ablation cases from complete arm access, discharge home one hour after procedure?***

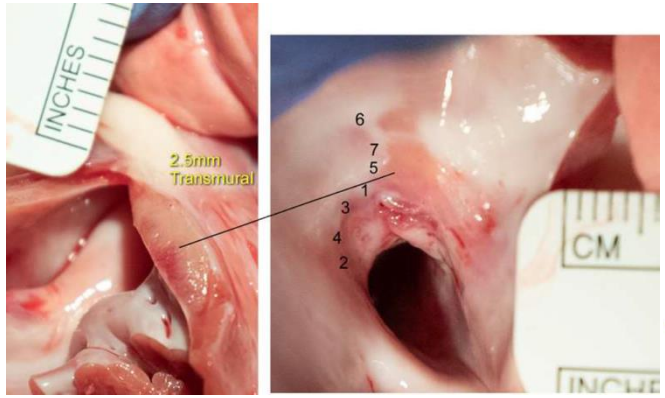
Future value: Automation



+ PFA= Efficient/Reproducible Ablation?







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Thank you!