

ATRIAL FIBRILLATION ABLATION - 2026 UPDATE

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Disclosures: None

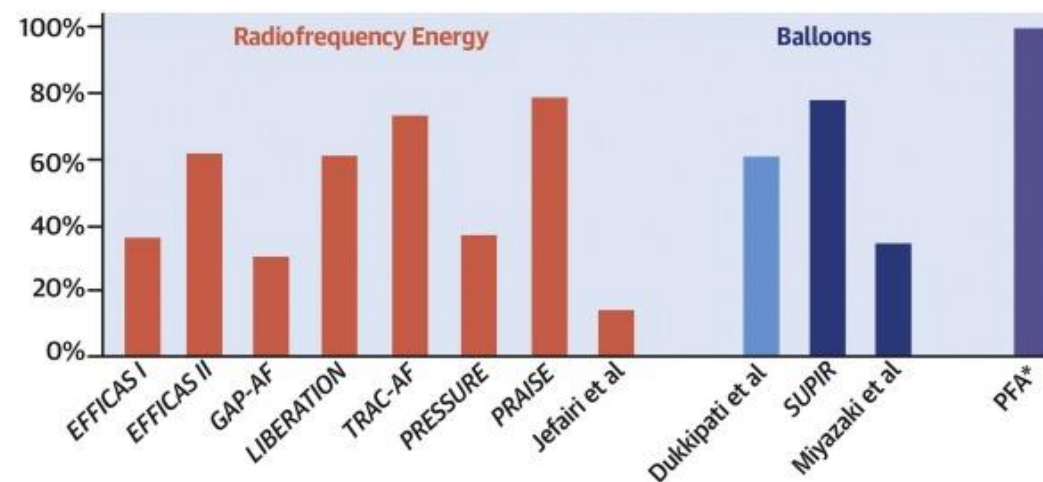
OBJECTIVES

- 1) Brief historical perspective
- 2) Practical focus
- 3) Relevant recent consensus/research

CENTRAL ILLUSTRATION: Pulmonary Vein Isolation for Atrial Fibrillation by Pulsed Field Ablation

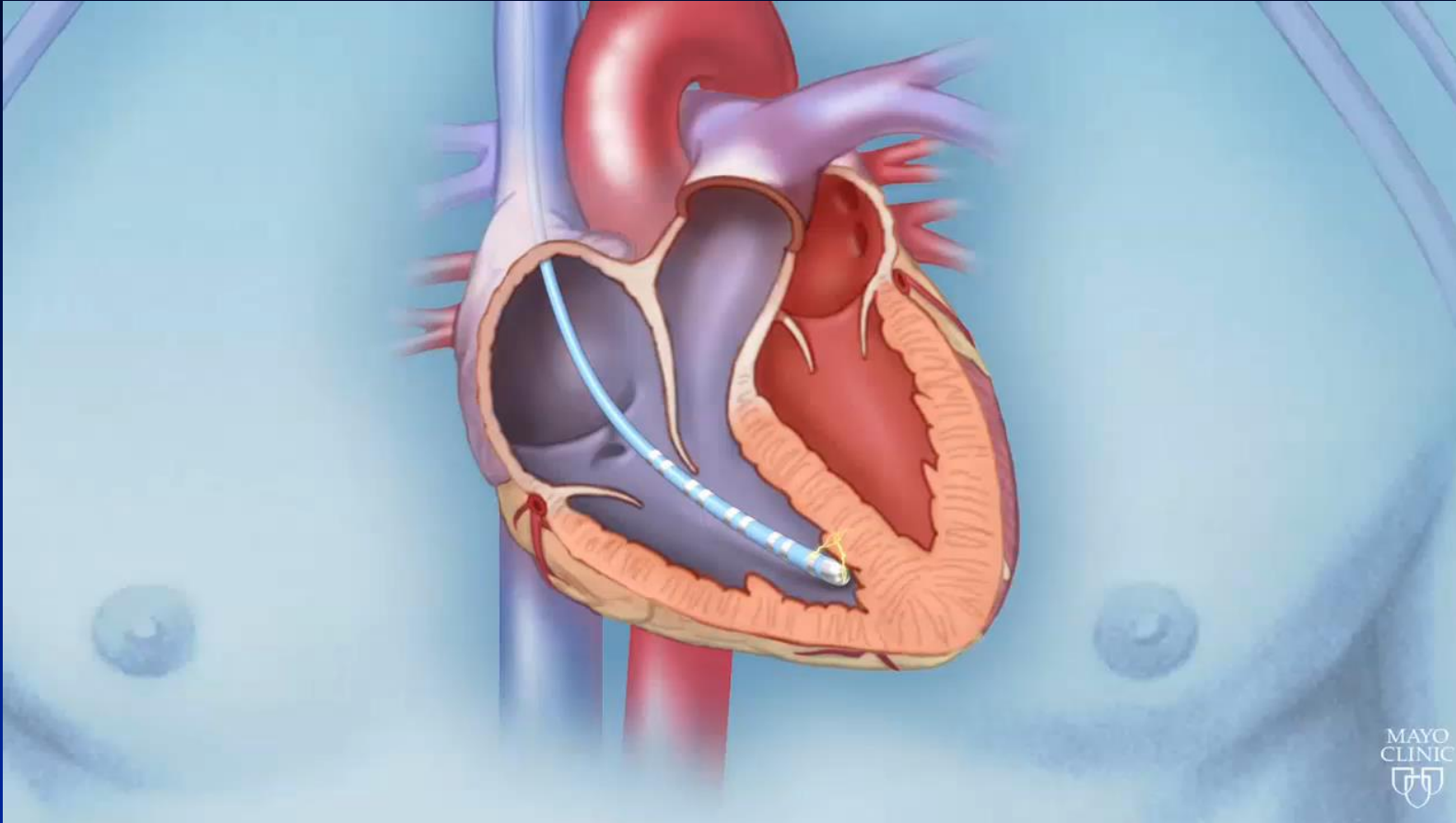
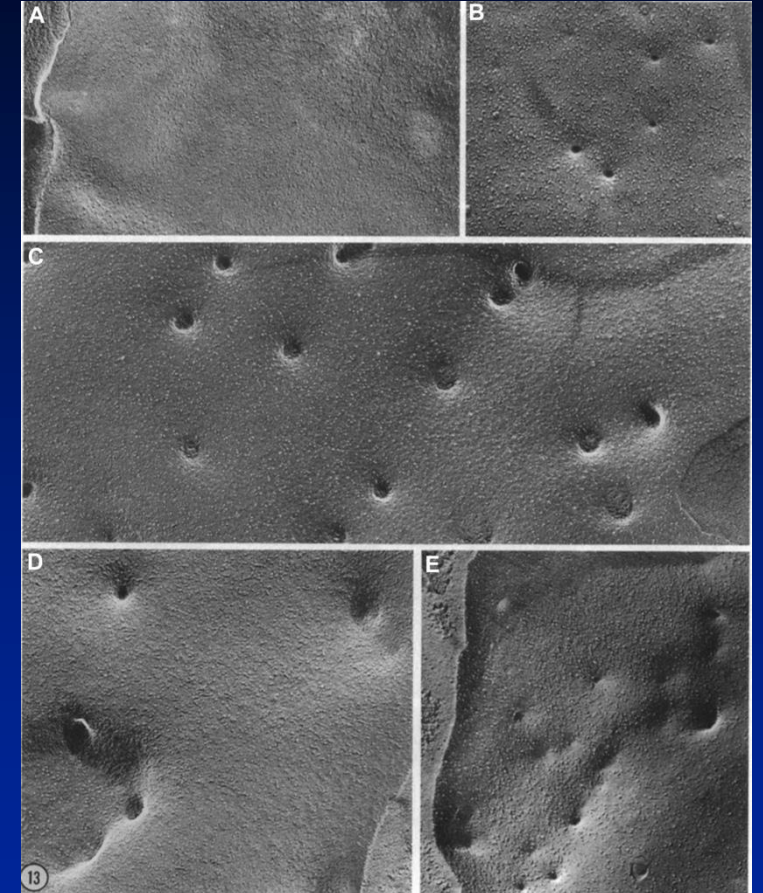


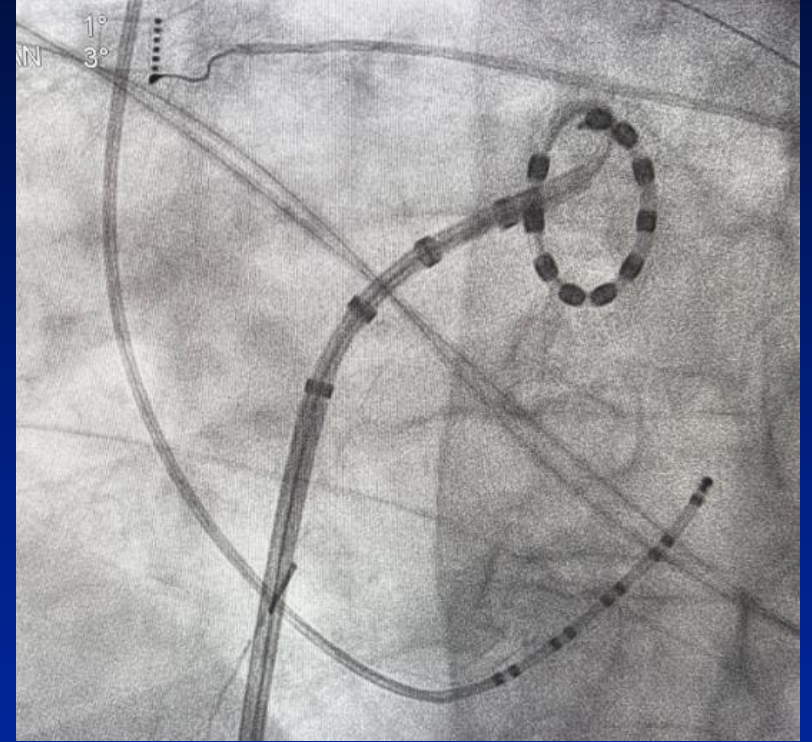
Frequency of Patients With ALL PVs Durably Isolated

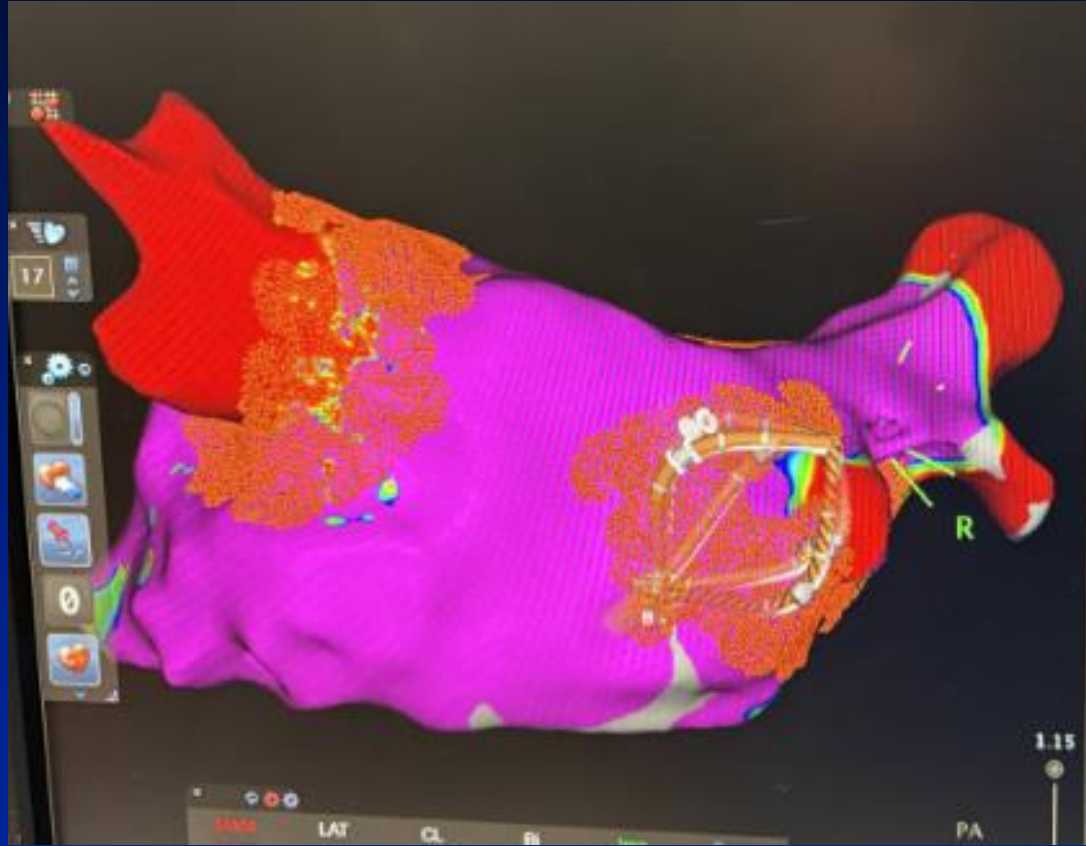
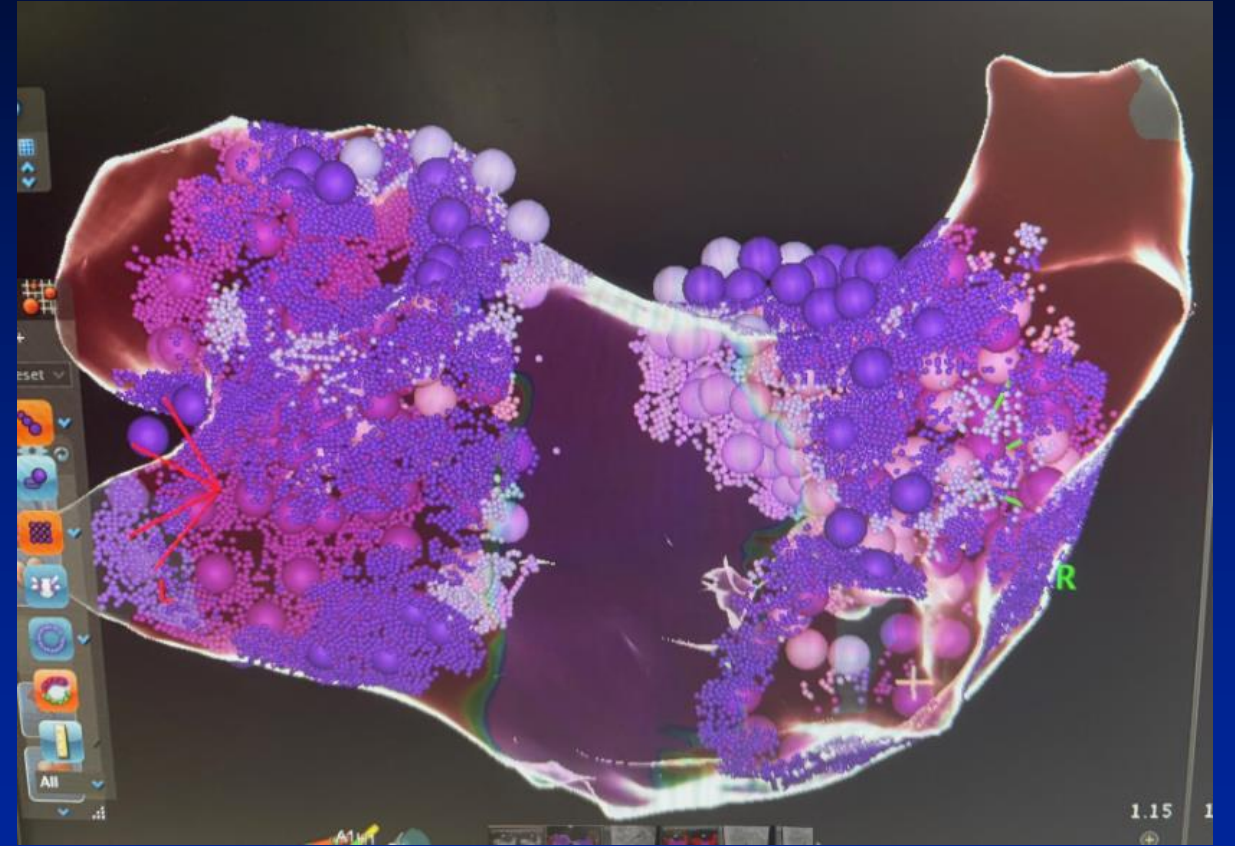


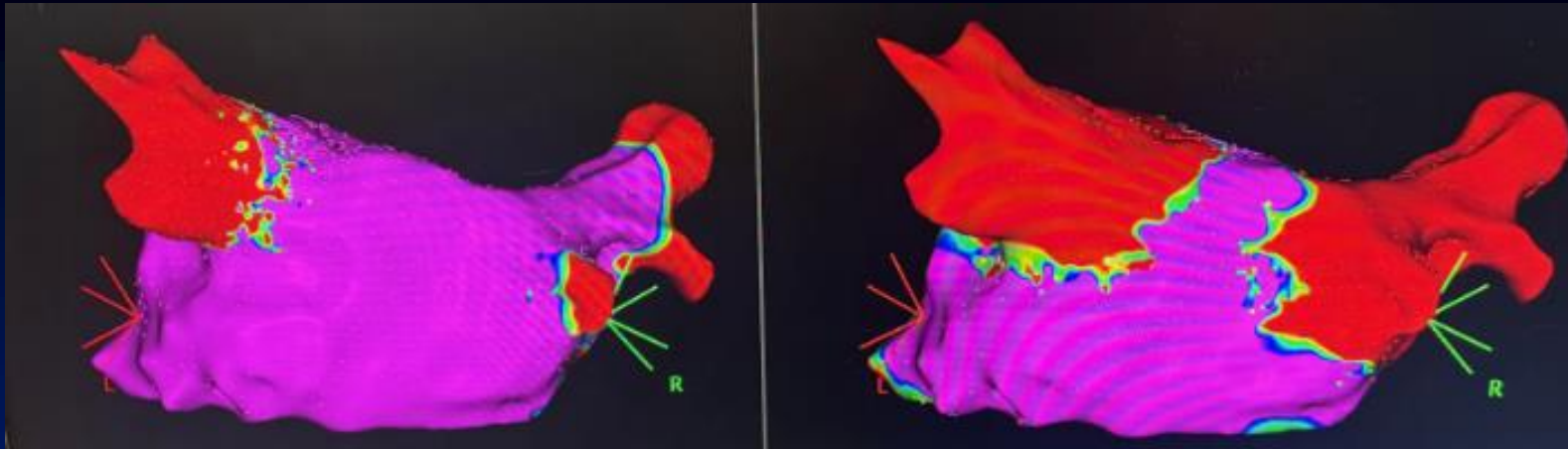
Reddy, V.Y. et al. J Am Coll Cardiol. 2019;74(3):315-26.

Pulsed Field Ablation

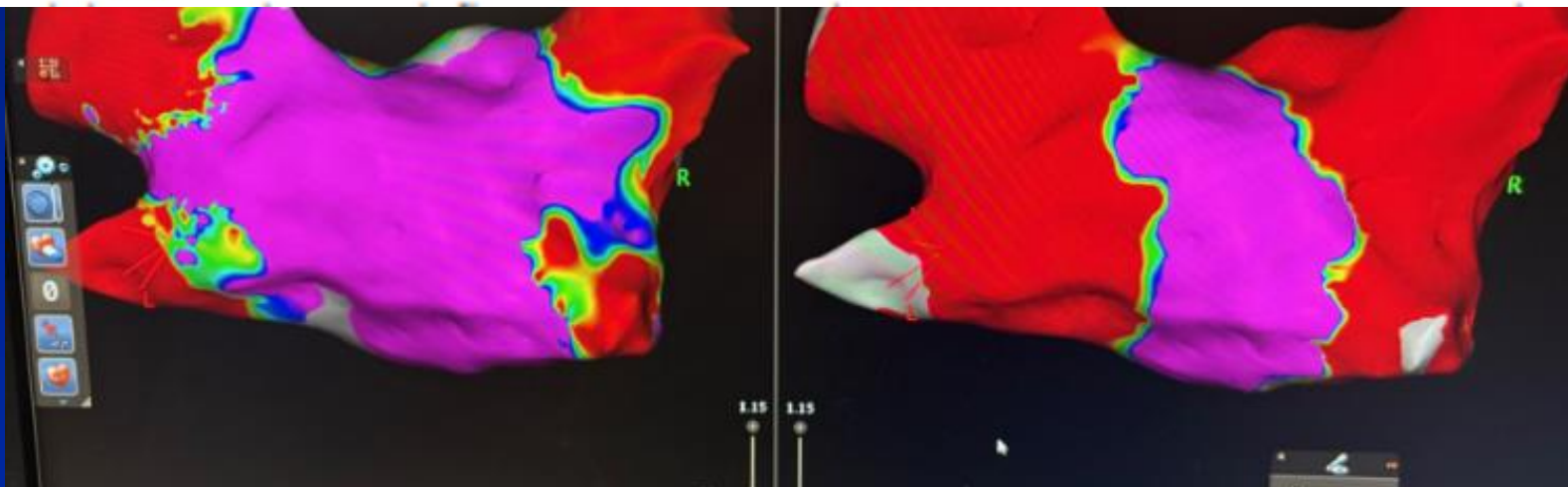








data.^{25,29,73,115} In clinical real-world data, however, PVI durability with PFA is not yet optimal and may be due to inadequate catheter-tissue contact, insufficient numbers of applications, or poor overlap of lesions.¹¹⁶ Therefore,





News from the Heart Rhythm Society

2026 HRS/EHRA scientific statement on pulsed field ablation for cardiac arrhythmias ^e

Atul Verma, MD, FHRS (Co-Chair),¹ Méléze Hocini, MD, FHRS (Co-Chair),^{2,3} Jason Andrade, MD, FHRS,⁴ Edward Gerstenfeld, MD, FHRS,⁵ Suraj Kapa, MD, FHRS,⁶ Dhanunjaya Lakkireddy, MD, FHRS,⁷ Damijan Miklavcic, PhD,⁸ Andrea Natale, MD, FHRS,⁹ Jonathan Piccini, MD, FHRS,¹⁰ Boris Schmidt, MD, FHRS,¹¹ Melanie A. Gunawardene, MD, FHRS (Scientific Documents Committee Liaison)^{11,12}

Table 2 Reported efficacy and complications from single-arm and randomized studies

Study name	Monitoring	End point	Efficacy	Safety	FDA or CE mark
Single-arm studies					
PULSED AF (PulseSelect Pulsed Field Ablation System; Medtronic, Inc) ⁷⁰	TTM: weekly and when symptomatic (3-12 mo) ECG: 3, 6, and 12 mo Holter: 24 h at 6 and 12 mo	Primary effectiveness end point: freedom from a composite of acute procedural failure, arrhythmia recurrence, or antiarrhythmic escalation through 12 mo Primary safety end point: freedom from a composite of serious procedure- and device-related adverse events	Paroxysmal AF: 66.2%; Persistent AF: 55.1%	Primary safety end point occurred in 1 patient (0.7%; 95% CI, 0.1-4.6) in both paroxysmal and persistent AF cohorts	FDA
INSPIRE (Varipulse with Trupulse PFA generator; Biosense Webster, Inc) ⁷²	Remote monitoring: weekly between month 3 and 5; monthly between 6 and 12 mo ECG: 1, 3, 6, and 12 mo	Primary effectiveness end point: freedom from arrhythmia of ≥ 30 s duration after 3-mo blanking period Primary safety end point: incidence of primary adverse events within 7 days of initial ablation, including pericarditis, myocardial infarction, cardiac tamponade/perforation, thromboembolism, stroke, TIA or cerebrovascular accident, phrenic nerve paralysis, or major vascular access complication/bleeding, as well as death, PV stenosis, and atrioesophageal fistula that occurred later than 7 d post-procedure	WAVE II: 12-month freedom from arrhythmia recurrence: 78.9%	No primary adverse events	FDA
AdmIRE (Varipulse with Trupulse PFA generator; Biosense Webster, Inc) ⁷¹	Remote monitoring: weekly between 3 and 5 mo; monthly between 6 and 12 mo ECG: 1, 3, 6, and 12 mo Holter: 24 h at 3, 6, and 12 mo	Primary effectiveness end point: composite end point: 12-mo freedom from documented atrial tachyarrhythmia episodes, failure to achieve PVI, use of a non-study catheter for PVI, repeat procedure (except for one repeat during blanking), taking a new AAD or dose escalation of previously failed class I or III antiarrhythmic or direct current cardioversion after blanking Primary safety end point: primary adverse event within 7 d of ablation	12-mo primary effectiveness end point: 74.6% 1-y freedom from arrhythmia: 75.4%	2.9% (8 of 272), with the most common complication being pericardial tamponade	FDA
ADVANTAGE AF (FARAWAVE; Boston Scientific, Inc) ⁷⁵	24-h Holter monitoring at 6 and 12 mo + twice monthly and symptomatic TTM	Primary effectiveness end point: acute success and post-blanking 1-y freedom from atrial tachyarrhythmia recurrence (>30 s), repeat ablation, cardioversion, or antiarrhythmic drug escalation Primary safety end point: incidence of predefined adverse events	Primary effectiveness: 63.5% at 1 y Freedom from symptomatic AF: 85.3% Success rate varied by operator experience: Less experience: 52.5% More experience: 73.8%	Primary safety end point was 2.3%, including 1 pericarditis, 1 myocardial infarction, and 4 pulmonary edema	FDA

ADVANTAGE AF phase 2 (FARAWAVE; Boston Scientific, Inc) ⁷⁴	Continuous rhythm monitoring after ablation with insertable cardiac monitors	Primary composite effectiveness end point: (1) acute success of PVI and PWI, both using only the investigational catheter for ablation; (2) post-3-month blanking freedom from recurrence of AF/AFL/AT; (3) freedom from re-ablation for AF/AFL/AT; (4) freedom from any DCCV for AF/AFL/AT; and (5) freedom from use of new or escalated doses of class I/III AADs or any post-blanking amiodarone. Primary safety end point: Rate of predefined safety events	Freedom from atrial arrhythmia (AA): 73.4% Freedom from atrial arrhythmia of ≥ 30 s: 52.0% No episode exceeded 24 h in 94.0% Atrial arrhythmia burden $>0.1\%$ and longest episode duration >1 h were predictive of increased health care use	Primary safety event rate FDA was 2.4% (3 stroke, 1 cardiac tamponade and 1 death)
PULSAK (Globe PT System; Kardium, Inc) ⁸²	1 IM weekly + symptoms, and 24-h Holter monitoring at 6 and 12 mo	Primary effectiveness end point: freedom from treatment failure at 12 mo Primary safety End point: safety events to 6 mo post-PFA	Primary effectiveness end point at 12 mo: 80.8%	Primary safety event rate: 0.6% (1 stroke)
VOLT CE (Abbott Laboratories) ³⁰ Interim analysis at 6 months	Follow-up ongoing 12-lead ECG: 3 mo TTM: Every 14-d period between the 3- and 6-mo visits 24-h Holter: 6 mo	Primary effectiveness end point: Composite of AF/AFL/AT episodes >30 s in duration documented by protocol-specified 12-lead ECG, TTM, or Holter monitor after the 90-d blanking period Primary safety end point: rate of experiencing a pre-defined device and/or procedure-related serious adverse event within 7-d of any ablation procedure	Freedom from documented arrhythmias was 88.2% in paroxysmal AF patients and 76.7% in persistent AF patients	4 (2.7%; 4/146) primary serious adverse events
VOLT Investigational device exemption. (Abbott Laboratories) ⁶⁹		Acute effectiveness: confirmation of PV isolation via entrance block after a 20-min wait period Primary safety end point: device and/or procedure-related serious adverse event with onset within 7 d of the ablation procedure	Paroxysmal AF: 99.4% of veins (666/670) in 98.2% of patients Persistent AF: 99.8% of veins (633/634) in 99.4% of patients	1.9% (2 cardiac tamponade, 1 pericarditis, 1 stroke, 1 vascular access complication, and 1 prolonged hospitalization)
FOCALFLEX CE Mark Trial (Abbott Laboratories) FlexPulse IDE Trial (Abbott Laboratories)	Estimated study completion date: 3/30/2026 Estimated study completion date: 4/30/2026			
Sphere-360 (Medtronic, Inc) ⁸³	In-person or virtual visits: 10 d, 75 d, 6 mo, 12 mo TTM: Weekly through 21 wk and monthly thereafter + when symptomatic 48-h Holter: 6 and 12 mo	Primary effectiveness end point: acute electrical isolation of all PVs Primary safety end point: Device-related serious adverse events within 7 d, including death, myocardial infarction, persistent phrenic nerve palsy, TIA, stroke, thromboembolism, major vascular complications/bleeding, heart block, gastroparesis, severe pericarditis, hospitalization (initial and prolonged) because of cardiovascular or pulmonary adverse events, cardiac tamponade/perforation (up to 30 d), PV stenosis (up to 180 d), and atrioesophageal fistula (up to 180 d)	The Kaplan-Meier estimate of 1-y freedom from atrial arrhythmias was 81.8% (95% CI, 70.2-89.2) for the total and 100% (95% CI, 80.6-100) for the PULSE3 cohort PVI durability was 90% and 99% on a per-vein basis for the total and PULSE3 cohort, respectively	No predefined primary safety events

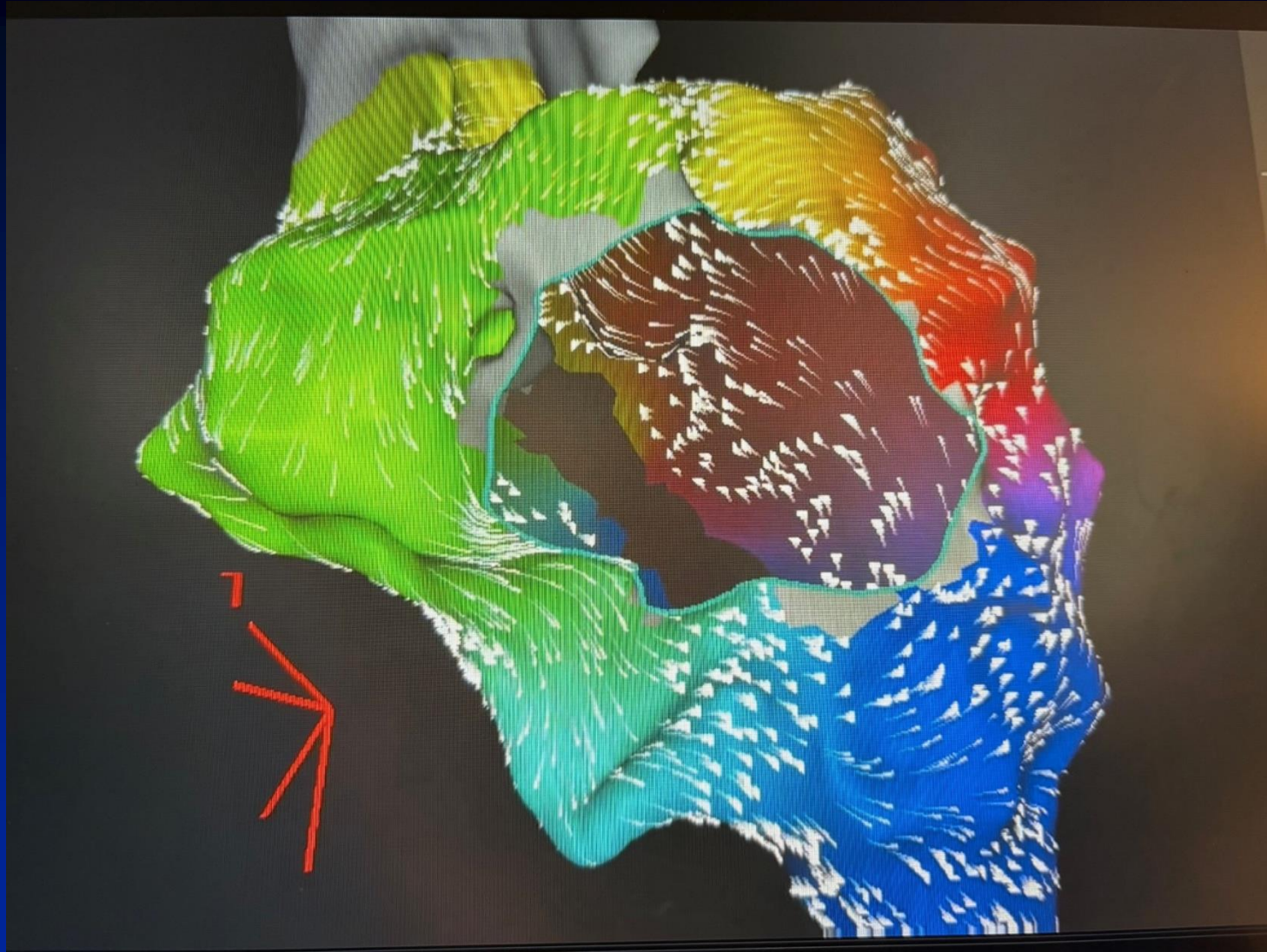
Study name	Monitoring	End point	Efficacy	Safety
ECLIPSE AF (Cardiofocus Centauri system) ²⁶	Follow-up was scheduled at 7-d, 30-d, 90-d, 6-mo, and 12-mo post-index procedure Cardiac CT and invasive high-density remapping of PVs at 90 d	Primary effectiveness end points: (1) acute success , defined as PVI achieved with the Centauri system during the index procedure assessed by entrance and exit block after a 20-min waiting period and (2) chronic success , defined as the per-patient and per-PV isolation rate at 90 ($\pm$ 15) d, assessed by high-density remapping and confirmation of entrance and exit block Primary safety end point: incidence of predefined system-related and procedure-related serious adverse events of interest within 30 d post-ablation	Acute procedural success was achieved in all 82 (100%) treated patients and 322 (100%) treated PVs, with first-pass isolation in 92.2% of PVs Chronic success: Development cohort 1 and 2: per-patient isolation rates of 38% and 26% and a per-PV isolation rates of 47% and 53% Optimized cohorts 3–5: per-patient isolation rates of 60%, 73%, and 81% and per-PV isolation rates of 84%, 90%, and 92%	Primary safety events in 4 (4.9%); all procedure-related Vascular access complications: 3 Exacerbated cardiac tamponade secondary to perforation leading to non-embolic stroke: 1 Other complications: Catheter perforation: 2 Esophageal injury: 2
SmartFIRE (Biosense Webster, Inc) ⁷⁶	12-lead ECG: pre-procedure, pre-discharge, and at 1-, 3-, 6-, and 12-mo visits and unscheduled visits (if any) 24-h Holter monitoring: 3, 6, and 12 mo TTM: Weekly: 1–5 mo Monthly: 6–12 mo, and following any symptomatic episodes, recorded for 1 min	Effectiveness end point: Acute procedural failures; freedom from symptomatic and asymptomatic arrhythmia episodes of $\geq$ 30 s during days 91–365 on or off AAD Safety end point: Device or procedure-related serious adverse events (ie, death, life-threatening illness or injury, permanent impairment of a body structure or a body function, in-patient hospitalization or prolongation of patient hospitalization, medical or surgical intervention to prevent life-threatening illness or injury or permanent impairment to body structure or a body function, chronic disease, fetal distress, fetal death, or a congenital physical or mental impairment or birth defect)	Freedom from arrhythmia at 12 mo: 71.5% (84.2% when using standard-of-care monitoring only) Clinical success rate (freedom from symptomatic arrhythmia): 86.4% Single procedural success: 81.0% Use of class I/III AAD decreased from 60.3% at baseline to 23.9% at 6–12 mo post-ablation	Device/procedure-related serious adverse events: 5 (3.6%) Cardiac tamponade: 2 PV stenosis: 2 Anaphylactic shock: 1 Cardiovascular hospitalization rate reduced from 20.1% to 11.9% during the 12 mo before vs after ablation, respectively
The first-in-human VCAS trial (Field Medical, Inc) ⁸⁴	Follow-up for 180 d with visits at pre-discharge, 30 d, 90 d, and 180 d post-ablation. During these visits, blood labs, ECGs, ICD interrogations, adverse events, and physical exams were performed	Primary end point: to assess the incidence of device- or procedure-related complications within 180 d of the procedure Secondary end points: procedural efficiency, arrhythmia burden, and arrhythmia recurrence	Freedom from recurrent VT/VF or ICD shock: 81.8% [95% CI, 67.1–99.8] VT/VF burden: significantly decreased from baseline to post-PFA by 98% vs 0%; $P < .001$	Primary safety end points within 180 d occurred in 3 of 26 (11.5%) patients: Cardiogenic shock followed by death Heart failure hospitalization Retroperitoneal bleed

Randomized studies					
ADVENT (FARAPULSE; Boston Scientific, Inc) ⁶⁵	TTM: weekly (3-12 mo) + when symptomatic ECG: 3, 6, and 12 mo Holter: 72 h at 6 and 12 mo	Primary efficacy end point: freedom from a composite of initial procedural failure, documented atrial tachyarrhythmia after a 3-month blanking period, AAD use, cardioversion, or repeat ablation Primary safety end point: acute and chronic device- and procedure-related serious adverse events	Primary end point (success rate): PFA 73.3% vs thermal ablation 71.3%	PFA: 6 (2.1%) Thermal: 4 (1.5%) Mean change in the cross-sectional area of the PVs: -0.18 cm^2 (0.9%) with PFA and -1.18 cm^2 (12.0%) with thermal ablation	FDA
CHAMPION SINGLE SHOT (FARAPULSE; Boston Scientific, Inc) ⁶⁶	Continuous rhythm monitoring after ablation with implantable cardiac monitors	Primary end point: recurrence of atrial tachyarrhythmia between day 91 and day 365 after ablation Safety end point: composite of procedure-related complications	Recurrence rate: PFA 37.1% vs cryoballoon 50.7%	1 patient in the PFA vs 2 patients in the cryoballoon group met the safety end point	
SPHERE PER-AF (Aflera; Medtronic, Inc) ⁶⁷	Office visits: 1, 3, 6, and 12 mo 24-h Holter: 6 and 12 mo 12-lead ECG: 3, 6, and 12 mo	Primary effectiveness composite end point: failure to acutely isolate all targeted PVs and complete all left atrial ablation with the assigned study device; repeat ablation at any time after the index procedure; and, after a 3-month blanking period, documented occurrence of atrial tachyarrhythmia, escalation or initiation of class I or class III anti-arrhythmic drugs, or cardioversion Primary safety end point: composite of prespecified device-related or procedure-related serious adverse events	Success rate: Dual-energy SPHERE-9 arm 73.8% vs traditional RFA arm (control) 65.8%	Primary safety events occurred in 3 (1.4%) patients in the investigational arm and in 2 (1.0%) patients in the control arm	FDA
BEAT-PAROX AF (FARAPULSE; Boston Scientific, Inc) ⁶⁸	Telephone follow-up at 1 month, in-person follow-up at 2, 6, and 12 mo. Weekly self-recorded single-lead ECGs with hand-held ECG (AliveCor Kardia) and symptom-driven recordings	Superiority trial Primary end point: single-procedure success rate after 12 mo defined as the absence of ≥ 30 s atrial arrhythmia recurrence, class III antiarrhythmic drug resumption after a 2-mo blanking period, or any repeat ablation Secondary effectiveness end points: (1) Multiple procedure success (2) Quality of life (3) Proportion of participants with death, strokes, or embolic events from arrhythmia up to 12 mo after the index ablation procedure Secondary safety end point: composite of prespecified device- and procedure-related serious adverse events within 7 d after the procedure	PFA arm: 112/145 (77.2%) RFA arm: 111/143 (77.6%) Adjusted risk difference 0.9% (95% CI, -8.2 to 10.1 ; $P = .84$)	Composite safety end point of at least one adverse event per patient: PFA arm: 7 (4.8%) including 1 TIA, 1 pericarditis, 6 hospitalizations, 1 vascular access complications RFA arm: 11 (7.6%), including 2 cardiac tamponade, 1 pericarditis, 9 hospitalizations, 4 vascular access complications, 2 pulmonary vein stenosis $> 70\%$	CE and FDA approved

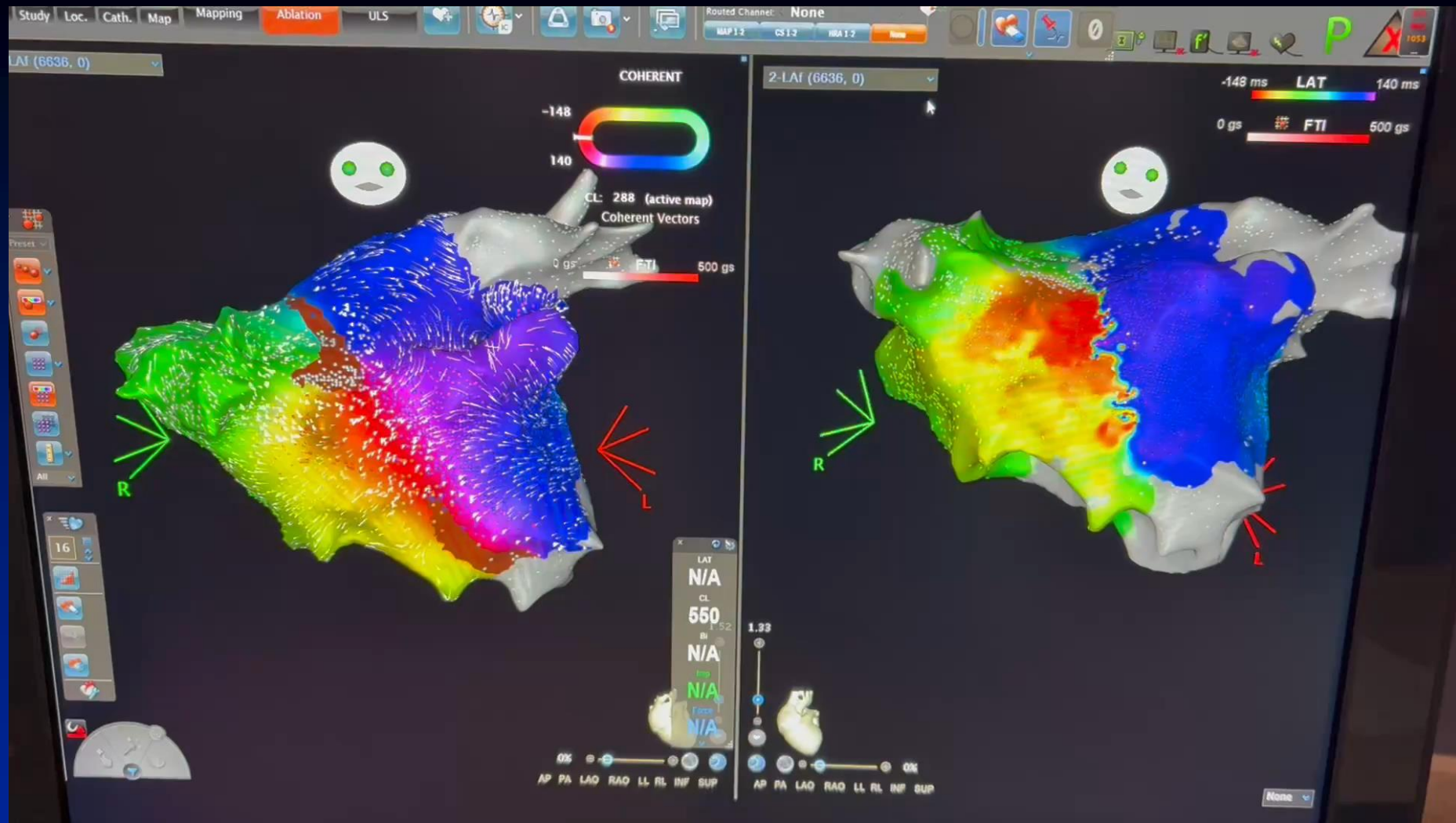
Table 3 Characteristics of PFA catheters

Brand name	Catheter	Descriptive name	Ablation energy	Diameter (mm)/size (F)	Irrigation/ flow (mL/min)	Number of applications recommended	Ablation mode/ configuration	Nominal amplitude	Integration in mapping/ mapping system	Waveform description	Vectoring/ activation pattern	Pulse duration	Number of trains/ application	Contact sensing/type
Farawave Boston Scientific		Pentaspine 20 electrodes (4 electrodes on each of 5 splines)	PFA	31 & 35 mm/ 12F	Saline drip	8 applications per vein (nominal)	Bipolar	1800-2000 V	Yes	Biphasic	Between spline pairs	Microseconds	5	Local impedance
OptiShot Cardiofocus		Compliant PFA balloon	PFA	Up to 40 mm/ 12F	No	1 per position/1 per vein	Bipolar	Up to 2 kV	Not required	Biphasic	Simultaneous delivery to non-adjacent splines	Microseconds	Not provided	Direct visual confirmation
Farapoint Boston Scientific		Focal	PFA	8F	No	3-5 mm between lesions	Bipolar	1400-2000 V	Yes	Biphasic	Between electrode pairs	Microseconds	5	Local impedance (future)
PulseSelect Medtronic		Circular: 9 electrodes	PFA	25 mm/9F	Not irrigated	Minimum of 8 per vein	Bipolar	1500 V	Yes (compatible with all mapping systems)	Biphasic	Dual field: odd and even electrodes activated separately during pulse train	Microseconds	4	In development/ impedance-based
Varipulse Biosense Webster		Variable loop: 10 electrodes	PFA	25-35 variable/ 8.5F	Yes	≥12 per vein	Bipolar	1800 V	Yes	Biphasic	Between adjacent electrodes	Microseconds	Not provided	Impedance
Sphere-9 Medtronic		Large-tip focal	PFA & RFA	9 mm/8F	Yes/15 mL/min (PF); 30 mL/min (RF)	5-6 mm between lesions, user configurable	Monopolar	Up to 2000 V	Yes/Affera Prism	Biphasic	Lattice to return patches	microseconds	12	Impedance and temperature change after starting ablation
Centauri Cardiofocus (Galaxy)		Focal	PFA	3.5-4 mm/8F	4 mL/min	4-5 mm between lesions	Monopolar	19 A, 22 A, 25 A, up to 3.5 kV	Yes	Biphasic	Unipolar to patch	Microseconds	Not provided	Contact force
Globe System Kardium		122 electrode spherical array	PFA RFA (investigational)	30 mm/16F	Yes/100 mL/h (yes/ 1.67 mL/min) Heparin coated	1 application per vein /target area	Bipolar	1700 V	Yes/Globe System	Biphasic	2 to 64 electrodes simultaneously	Microseconds	2 to 6	Thermal contact mapping
STSF dual-energy Biosense Webster		Focal	PFA & RFA	3.5 mm/8F	Saline drip	Up to 24 applications, 28 s max, duration varies according to PF	Bipolar	1.0-1.5 kV	Yes	Biphasic	Unipolar to patch	Microseconds	Not provided	Contact force with direction vector
OMNY pulse Biosense Webster		Large-tip focal	PFA	12 mm/7.5F	Saline drip	Up to 12 applications, 14.5 s max, duration varies according to PF	Bipolar	1.0-1.5 kV	Yes	Biphasic	Bipolar 3 splines vs 3 splines	Microseconds	Not provided	Contact force with direction vector
Abbott Volt		Balloon in splined basket	PFA	28 mm/12.5F	None	Nominal waveform: minimum 2, average of 4 Low waveform: minimum of 3	Bipolar	Nominal: 1700 V Low: 1345 V	Yes	Biphasic	Spline to neighboring spline in sequence around the 8 splines	Microseconds	10	Yes: complex impedance (LivePoint)

Abbott Tactiflex Duo		Focal	PFA & RFA	4 mm tip/8F	2 mL/min baseline 13 mL/min on PF and RF	1 application per location for atrial locations	Monopolar	Nominal: 2232 V Low: 1950 V	Yes	Biphasic	Unipolar to patch	Microseconds	Nominal: 5 trains Low: 10 trains	Yes: Light-interferometry contact force
Sphere-360		Very large array	PFA	34 mm/8F	Not irrigated	3–4 per vein	Monopolar	Not provided	Yes/Affera Prism	Biphasic	6 panels activated individually to return patch	Microseconds	Not provided	Impedance
nsPFA, PulseBiosciences		Very large array	PFA	30 mm/11F	No	1 ostial and 1 antral application per vein	Bipolar	Not provided	Feasibility clinical integration with EnSite and CARTO	Monophasic	Between rings	Nanoseconds	Not provided	No
ElectroPulse, CathRx		Variable loop: 10 electrodes	PFA	2.33 mm/8F	No	1 per location	Bipolar	2800 V	Yes	Biphasic	Between adjacent electrodes	Microseconds	7	Yes
LotosPFA Insight Medtech		Interconnected spline in spindle and lotus configurations	PFA	28 or 31 mm/11F	Saline drip	8 applications per vein	Bipolar	2100 V	No	Biphasic	Between adjacent electrodes	Nanoseconds	5 trains per site	No
Adagio		Very large array	PFA	20–25 mm/8.5F	Not irrigated	Not provided	Bipolar	1100 V	Feasibility with Ensite	Biphasic	Between adjacent electrodes	Not provided	1	Not provided
Faraflex Boston Scientific		Large focal	PFA	10 mm/8F	2 mL/min	5–6 mm between lesions	Monopolar/bipolar	2000 V	Yes	Biphasic	Monopolar: distal electrode-patch; bipolar: distal - proximal	Microseconds	5	Local impedance
QuickShot Cardiofocus		Map & ablate mini basket	PFA	10 mm/8.5F	2 mL/min	1 per position	Monopolar	33 A, 40 A up to 5 kV	Yes	Biphasic	Unipolar to patch	Microseconds	Not provided	Yes: impedance algorithm
Field Medical		Focal	PFA	8.5F	Irrigated	Not provided	Monopolar	>10 kV	Feasibility with CARTO	Monophasic	Not provided	Nano/microseconds	Not provided	Yes
Arga Medtech SA		Circular, linear, focal	PFA	25 mm/7F	No	5–7 applications per PV	Bipolar, monopolar, and combination	2250–3250 V	No	Biphasic, coherent sine wave	Not provided	Microseconds	Not provided	Yes: impedance
ElePulse® PFA System (CRC EP, Inc. USA)		Dual spiral PFA catheter with 12 or 16 electrodes	PFA	8.4 F shaft 25-mm or 30-mm diameter	No irrigation required	One application per target. No rotations required	Bipolar	> 2000 V	Compatible with EnSite or Carto	Biphasic	All selected electrodes are energized simultaneously. Active electrodes are selectable on generator GUI. In case of electrode collision, the generation disables the colliding electrodes	Microseconds	25 trains over 15-s application duration	Real-time impedance for all selected electrodes

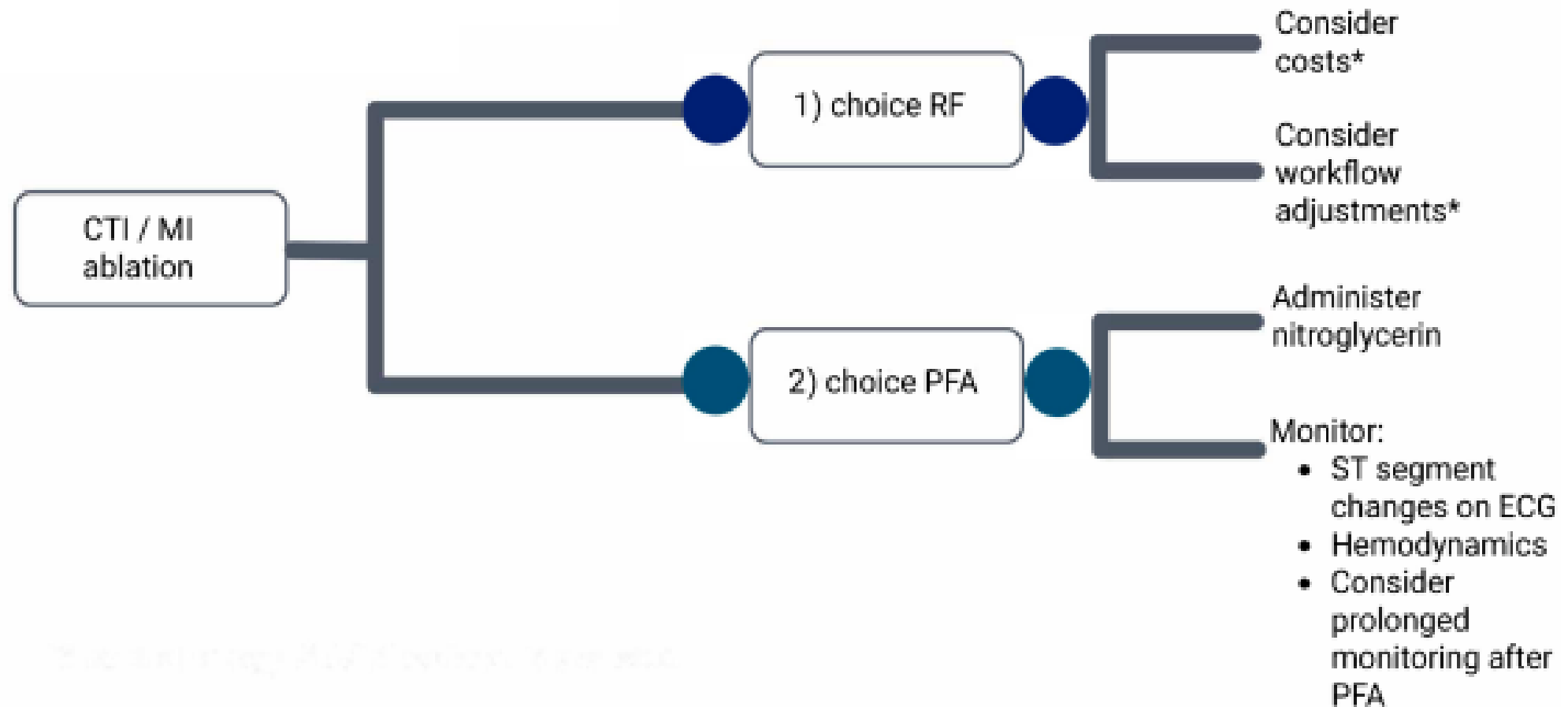


8% - 50% RECURRENCE RATE (SMALL STUDIES)



Demian J, Younis A, Wazni OM, et al. Pulsed-field ablation of atrial flutter: insights from a large volume U.S. Center. JACC Clin Electrophysiol 2025; 11:2394-2403.

3.9% recurrence rate at median 175 days MVI or CTI



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Table 5 Safety of PFA vs R

Complication

Coronary spasm
Pericarditis
Pericardial tamponade
Pulmonary vein stenosis
Phrenic nerve injury

Atrioesophageal fistula
Major vascular complication
Stroke/TIA
Delayed coronary spasm/r
arrhythmias
Death (≤ 30 d post-ablation)
Hemolysis/hemoglobinuria

*Pulmonary vein stenosis has been
Ref 17.

Conclusion: A reported 1.0% of patients had procedure-related SAEs in the DISRUPT-AF registry, the first large real-world data set from the US, capturing early experience. This event rate is low compared to radiofrequency and cryoablation despite PFA being early on the adoption of this technology.

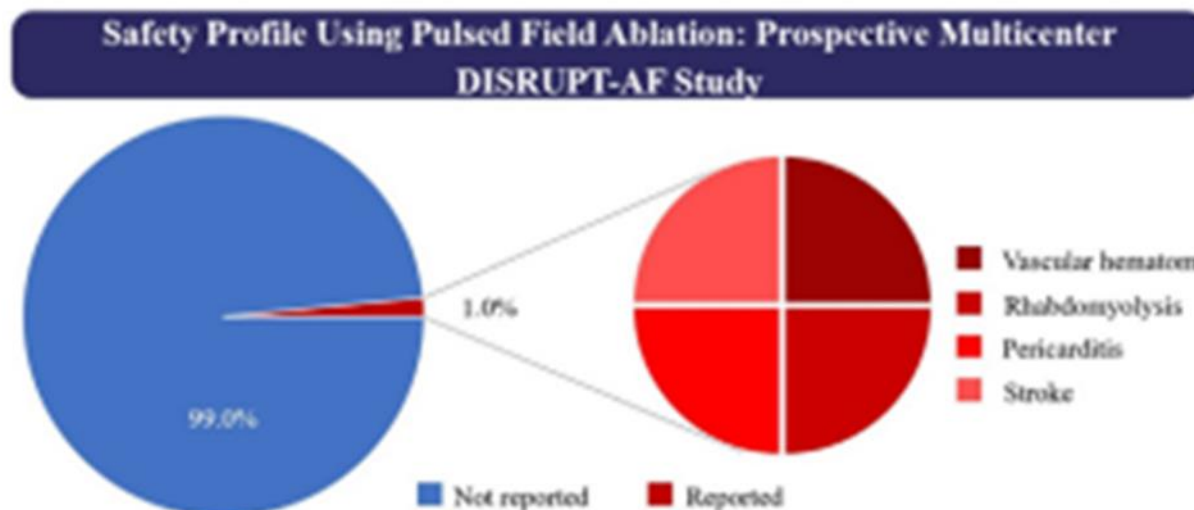


Figure 1 One percent of patients in the registry had procedure-related SAEs while 99% had no reported complications.

Pulsed field (PFA)

0.14%^{70,75,85,86,90}
0.7%^{70,75,85,86,90}
0.7%^{70,75,85,90}
0.7%^{70,75,85,86,90}
Transient: 0%–1.3%
Permanent:
0.4%^{70,75,85,86,90}
0.3%^{70,75,85,86,90}
0.95%^{70,75,85,86,90}
6%¹⁹⁸
0.3%^{70,75,85,86,90}
0.3%–0.4%^{70,75,85,90,200}

registries used for this table. See

TAKE HOME MESSAGES FROM PFA CONSENSUS STATEMENT

- 1) We recommend that pulsed field ablation is the preferred initial energy source for patients undergoing pulmonary vein isolation.
- 2) We suggest that intracardiac echocardiography be used, where available, to facilitate lesion formation by ensuring adequate tissue contact.
- 3) We recommend adequate overlap of pulsed field ablation lesions (eg, ~50%) to optimize durability and procedural success.
- 4) We recommend against rapid stacking of pulsed field ablation lesions in anatomic locations in close proximity to the esophagus or phrenic nerve.

POST-ABLATION ANTICOAGULATION DISCONTINUATION

Circulation: Arrhythmia and Electrophysiology

Volume 19, Issue 4, April 2026; Page e014692

<https://doi.org/10.1161/CIRCEP.125.014692>



ORIGINAL ARTICLE

Post-Catheter Ablation Long-Term Antithrombotic Strategies in Atrial Fibrillation: A Network Meta-Analysis of Randomized Controlled Trials

Juan F. Rodriguez-Riascos, MD , Dravid Navale, BA, Aakash Somappa, MBBS , Ricardo J. Estrada-Mendizabal, MD , Luis R. Scott, MD , Win-Kuang Shen, MD , and Komandoor Srivathsan, MD

Table. Studies Characteristics (Table view)

	Schricket et al, 2024 (ODIn-AF) ¹⁸	Kim et al, 2025 (ALONE-AF) ¹⁹	Verma et al, 2025 (OCEAN) ²⁰	Wazni et al, 2025 (OPTION) ²¹
Comparison	OAC vs no OAC	OAC vs no OAC	OAC vs aspirin	LAAO vs OAC
Sample size	200	840	1284	1600
OAC	99	423	641	797
LAOO	0	0	0	803
No OAC/LAAO	101	417	643	0
Mean age, y	67.2	64	66.3	69.6
Female sex	88 (44%)	209 (25%)	367 (29%)	546 (34%)
CHA ₂ DS ₂ -VASc	2.6	2.1	2.1	3.5
HASBLED	1.4	1.8	NR	1.2
Paroxysmal AF	133 (67%)	568 (68%)	852 (66%)	978 (61%)
Time after ablation	6 mo	≥1 y	≥1 y	Concomitant or after 90-180 d
OAC type	Dabigatran	Apixaban Rivaroxaban	Rivaroxaban	Apixaban 59% Rivaroxaban 27% Warfarin 5% Edoxaban 4% Dabigatran 4% Other <1%
Follow-up period, mo	12	24	36	36

JAMA. 2025;334(14):1246-1254. doi:10.1001/jama.2025.14679

JAMA. 2025;334(14):1246-1254. doi:10.1001/jama.2025.14679

QUESTION In patients without documented atrial fibrillation (AF) recurrence after catheter ablation and at least 1 non-sex-related stroke risk factor, does discontinuing oral anticoagulant therapy result in superior clinical outcomes?

CONCLUSION In patients without AF recurrence after catheter ablation, stopping oral anticoagulant therapy was associated with a lower risk of stroke, systemic embolism, or major bleeding vs continuing oral anticoagulant therapy.

631 Men
209 Women



Adults with a history of atrial fibrillation and no atrial arrhythmia recurrence after catheter ablation

Mean age: **64** years

18 Hospitals in South Korea

840 Patients randomized

417

Discontinue oral anticoagulation

Received no oral anticoagulation

423

Continue oral anticoagulation

Received either 5 mg of apixaban twice daily or 20 mg of rivaroxaban once daily



Rate of composite outcome at 2 years

Discontinue oral anticoagulation

0.3%

(1 of 417 patients)

Continue oral anticoagulation

2.2%

(8 of 423 patients)

No oral anticoagulation treatment resulted in a lower risk of a composite outcome:

Absolute difference, -1.9 percentage points
(95% CI, -3.5 to -0.3); *P* = .02

© AMA

Kim D, Shim J, Choi EK, et al; ALONE-AF Investigators. Long-term anticoagulation discontinuation after catheter ablation for atrial fibrillation: the ALONE-AF randomized clinical trial. *JAMA*. Published online August 31, 2025. doi:10.1001/jama.2025.14679

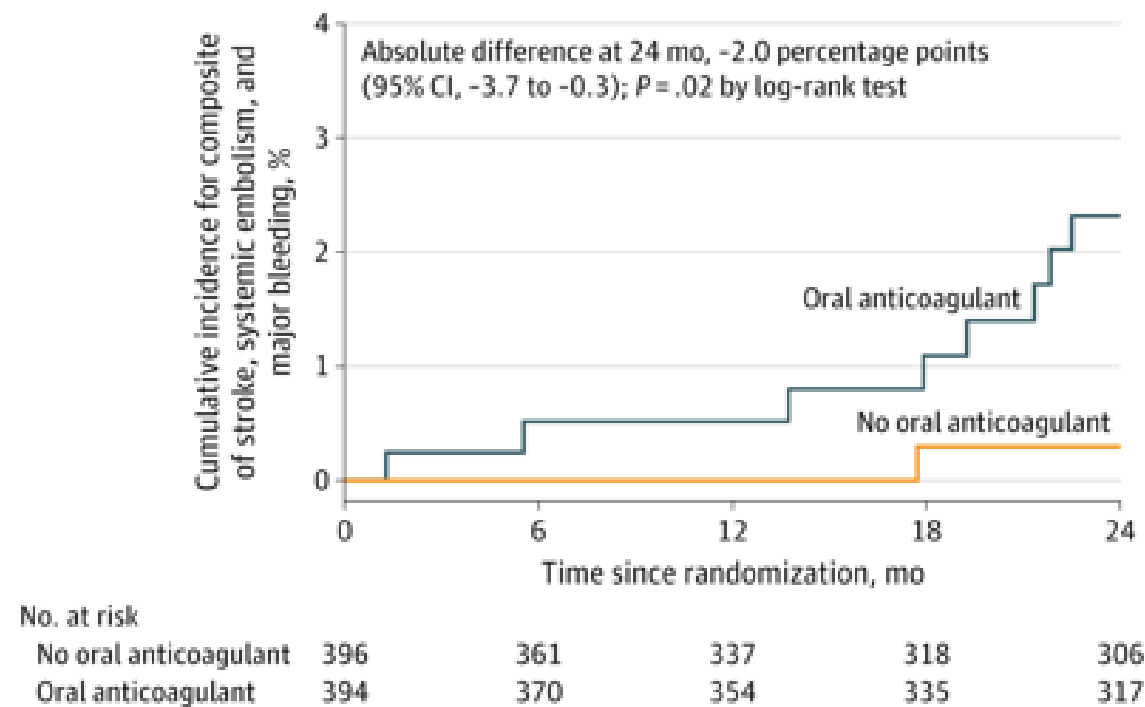


Figure Legend:

Primary Outcome in the Per-Protocol Population The data are presented as Kaplan-Meier curves for the primary outcome (composite of stroke, systemic embolism, and major bleeding) at 2 years.

Table 2. Primary and Secondary Outcomes at 2 Years

	Oral anticoagulant therapy status, No. of patients (%) ^a		Absolute difference, percentage points (95% CI) ^a
	Discontinued (n = 417)	Continued (n = 423)	
Primary outcome			
Composite of stroke, systemic embolism, and major bleeding	1 (0.3)	8 (2.2)	-1.9 (-3.5 to -0.3) ^b
Secondary outcomes: elements of the primary outcome ^c			
Stroke	1 (0.3)	5 (1.4)	-1.1 (-2.4 to 0.3)
Ischemic	1 (0.3)	3 (0.8)	-0.5 (-1.6 to 0.6)
Hemorrhagic	0	2 (0.6)	-0.6 (-1.3 to 0.2)
Systemic embolism	0	0	
Major bleeding	0	5 (1.4)	-1.4 (-2.6 to -0.2)
Intracranial	0	2 (0.6)	-0.6 (-1.3 to 0.2)
Gastrointestinal	0	2 (0.5)	-0.5 (-1.3 to 0.2)
Other	0	1 (0.3)	-0.3 (-0.8 to 0.3)
Additional secondary outcomes ^c			
Transient ischemic attack	2 (0.6)	0	0.6 (-0.2 to 1.3)
Myocardial infarction	0	0	
Clinically relevant nonmajor bleeding	5 (1.4)	7 (1.9)	-0.5 (-2.4 to 1.4)
All-cause mortality	0	0	
Hospitalization due to any causes	30 (8.3)	38 (10.0)	-1.7 (-5.8 to 2.5)

^a The percentages were calculated with the use of a Kaplan-Meier survival analysis of data in the intention-to-treat population; therefore, the percentages may not reflect the ratio of the numerator and the denominator.

^b *P* = .02 using the log-rank test for superiority.

^c For all of the secondary outcomes, the 95% CIs were not adjusted for multiple comparisons; therefore, inferences drawn may not be reproducible.

Original Article

Antithrombotic Therapy after Successful Catheter Ablation for Atrial Fibrillation

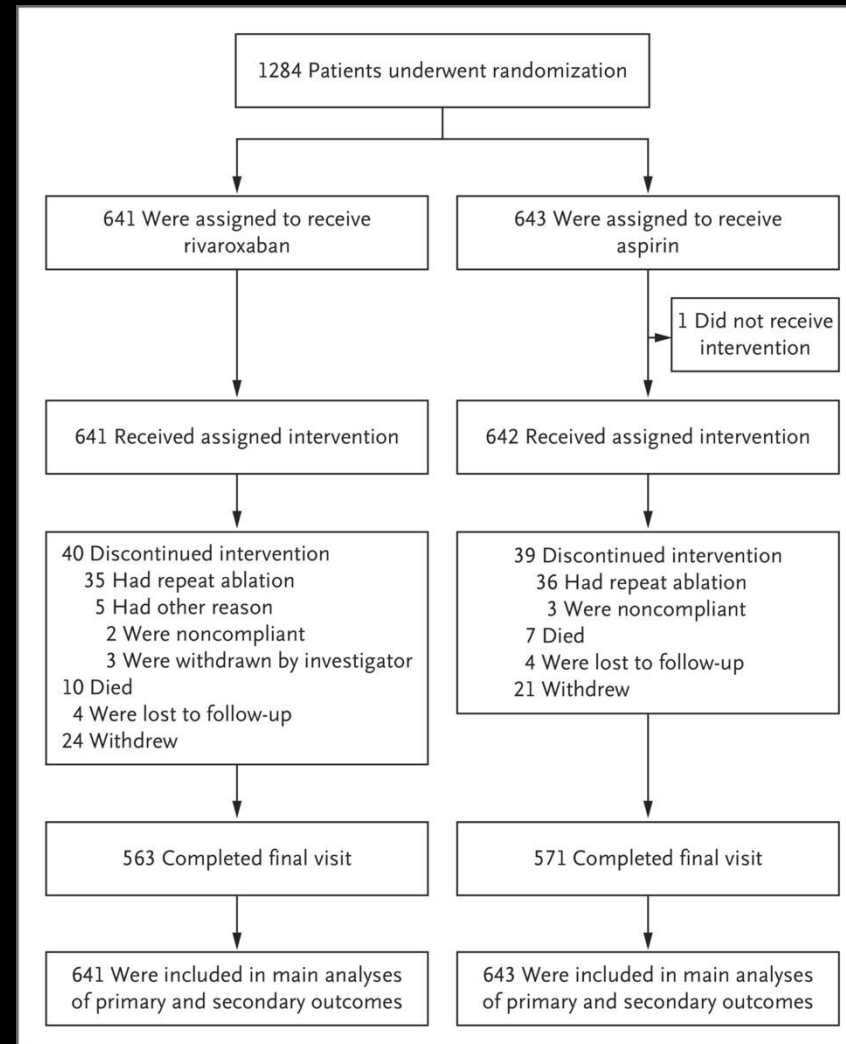
Atul Verma, M.D., David H. Birnie, M.D., Chenyang Jiang, M.D., Ph.D., Hein Heidbüchel, M.D., Gerhard Hindricks, M.D., Paulus Kirchhof, M.D., D.Sc., Jeff S. Healey, M.D., Yunhe Wang, M.D., Nikolaos Dagres, M.D., Marc W. Deyell, M.D., Prashanthan Sanders, M.B., B.S., Ph.D., Rajeev K. Pathak, M.B., B.S., Ph.D., Pieter Koopman, M.D., Dieter Nuyens, M.D., Paul Novak, M.D., Guy Amit, M.D., Charles Dussault, M.D., Bhavanesh Mankanjee, M.D., F. Russell Quinn, M.D., Umjeet Jolly, M.D., Leon Iden, M.D., Malte Kuniss, M.D., Mukul Sharma, M.D., Andrew Ha, M.D., Vidal Essebag, M.D., Ph.D., Jean Champagne, M.D., Michael D. Hill, M.D., Eric E. Smith, M.D., M.P.H., George A. Wells, Ph.D., for the OCEAN Investigators

N Engl J Med
Volume 394(4):323-332
January 22, 2026



The NEW ENGLAND
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Randomization and Follow-up.

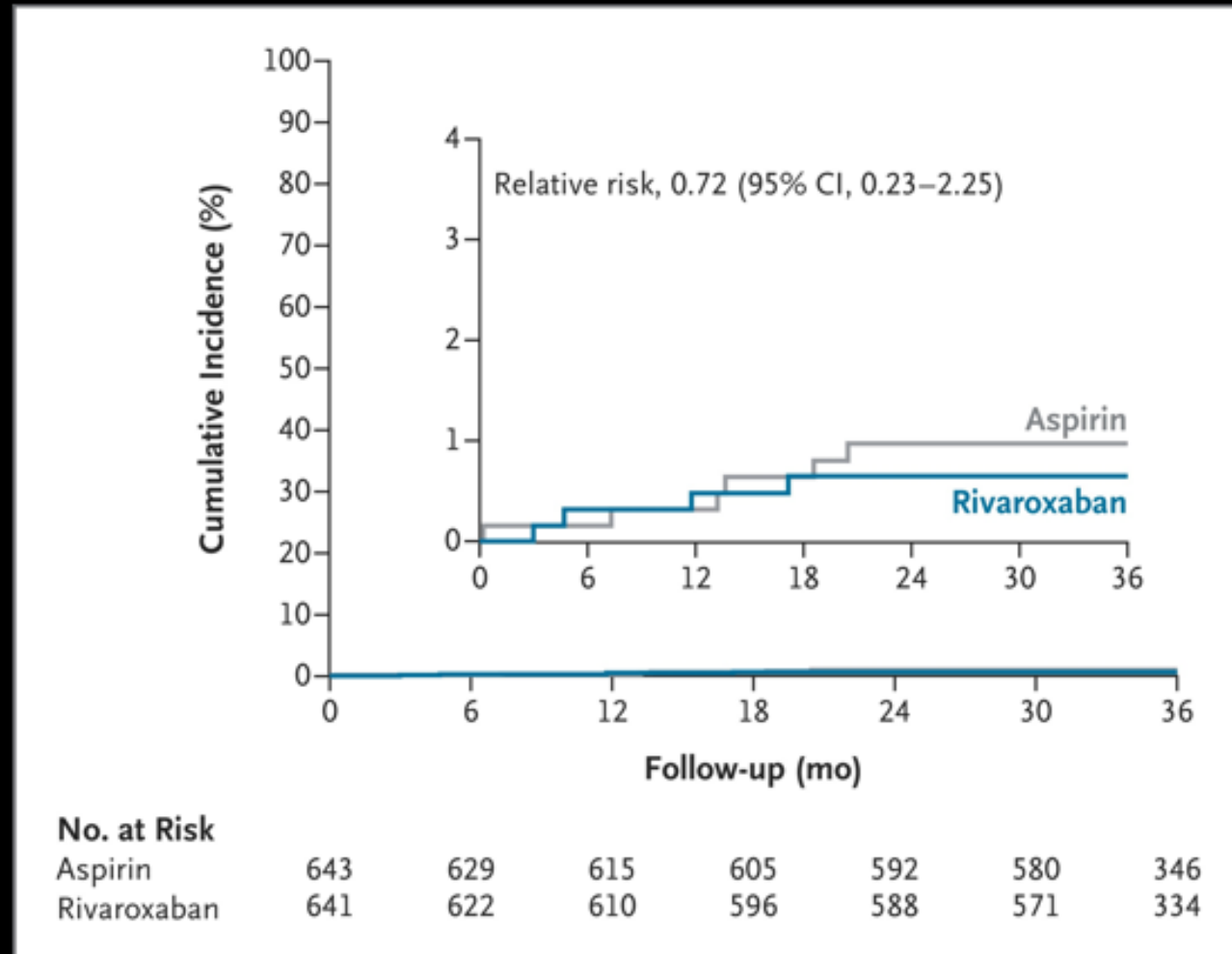


Verma A et al. N Engl J Med 2026;394:323-332



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Cumulative Incidence of Stroke or Systemic Embolism.



Verma A et al. N Engl J Med 2026;394:323-332

As dictated by either clinical findings and even asymptomatic with MRI

Conclusions

- Among patients who had had successful catheter ablation for atrial fibrillation at least 1 year earlier and had risk factors for stroke, treatment with rivaroxaban did not result in a significantly lower incidence of a composite of stroke, systemic embolism, or new covert embolic stroke than treatment with aspirin.



The NEW ENGLAND JOURNAL *of* MEDICINE

EDITORIALS



Anticoagulation after Ablation for Atrial Fibrillation — Navigating the OCEAN of Possibilities

Christine M. Albert, M.D., M.P.H.¹

It is important to emphasize that patients in both trials were predominantly at low risk for stroke, with mean CHA₂DS₂-VASc scores of 2.1 in the ALONE-AF trial and 2.2 in the OCEAN trial.

Taken together, these data suggest that patients with atrial fibrillation who have a low-to-moderate risk of stroke (CHA₂DS₂-VA score of ≤ 2) and undergo successful catheter ablation and monitoring for recurrent atrial fibrillation have a low enough risk of stroke that continued use of oral anticoagulants may not be justified, particularly given the associated bleeding risks. However, continued surveillance for recurrent atrial fibrillation seems prudent. Whether these findings extend to patients with higher CHA₂DS₂-VA scores remains uncertain, and extrapolation to this higher-risk population should be undertaken with caution.



PO-01-303 REAL-WORLD OUTCOMES OF CONCOMITANT PULSED FIELD ABLATION AND LEFT ATRIAL APPENDAGE CLOSURE: ACUTE SAFETY, FEASIBILITY, AND 3-MONTH IMPLANTATION RESULTS FROM *ALIGN-AF*

Amin Al-Ahmad, Byron J. Colley, Jose Osorio, Nischala Nannapaneni, John D. Day, Jasen Gilge, Anil Rajendra, John Allison, Khaled A. Awad, Nicholas O. Palmeri, Lukasz Cerbin, Rodney P. Horton, Matthew Martens, Steve Ruble PhD, Brad Sutton, Paari Dominic

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<https://doi.org/10.1016/j.hrthm.2026.03.1841>

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Pulsed field ablation (PFA) is a safe and effective treatment for atrial fibrillation (AF) and left atrial appendage closure (LAAC) reduces AF-related stroke risk. While the *OPTION* study established the feasibility of concomitant AF ablation and LAAC, it relied on earlier-generation technologies, leaving a critical gap in real-world evidence for contemporary PFA and LAAC devices. This study evaluates procedural and 3-month safety and efficacy outcomes of concomitant PFA and LAAC in real-world practice.

Methods

ALIGN-AF (NCT07041125) is a prospective multicenter *DISRUPT-AF* sub-study evaluating concomitant procedures using the pentaspline PFA system and PVDF-HFP coated LAAC devices. Procedures followed site standard of care with collection of procedural and acute outcomes. Follow-up at 3, 6, and 12 months assesses stroke, arrhythmia recurrence, LAAC seal, and device-related thrombus (DRT). Comparisons with standalone PFA procedures from *DISRUPT-AF* will also be available by presentation.

Results

A total of 123 patients (74.2±6.8 years; 52.5% female; 71.3% paroxysmal AF) underwent concomitant procedures by 24 operators at 12 U.S. centers. Procedures lasted 77.7±28.7 mins, with 59.7±34.0 mins of LA dwell time. Imaging guidance was ICE-only in 41.4%, TEE-only in 24.1%, and ICE+TEE in 33.6% of cases. Operators delivered 56±14 PFA applications, including 38±10 applications in the pulmonary veins (PVs), achieving 100% acute PV isolation. LAA orifice edema occurred in 5 patients (4.3%); however, overall LAA diameter did not change significantly post-ablation (Δ +0.35±1.41 mm; $p=0.72$). All cases achieved complete LAAC seal during the procedure. Three-month imaging showed complete closure in 91.3%, with no significant leak (>3 mm), DRT, or instability. Among the 25 patients with complete monitoring at submission, 1 pericardial effusion occurred that did not require intervention; no coronary spasm, stroke, TIA, or phrenic nerve injury was reported. Data monitoring is ongoing.

Application

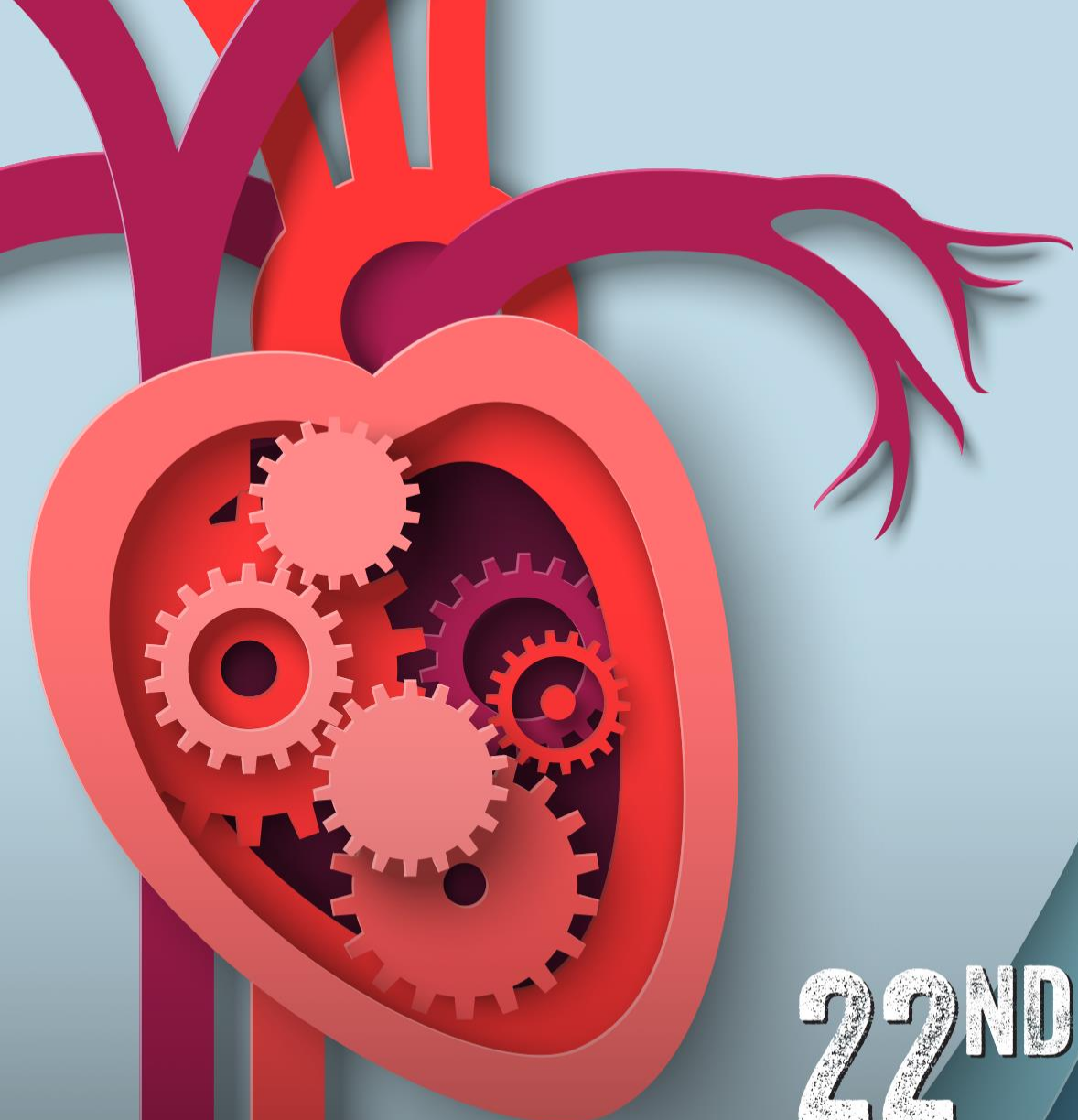
ALIGN-AF will provide the first monitored, prospective registry-based evaluation of contemporary concomitant PFA and LAAC. Early findings show the approach is safe, feasible, and preserves acute success, with stable, significant leak-free implants at 3 months. Ongoing follow-up will clarify the clinical value of this integrated strategy for patients and operators.

Next Steps/Future

Complete acute and 3-month data will be available by presentation. One-year follow-up will further assess stroke outcomes and freedom from AF.

CONCLUSION

- 1) PFA has changed the landscape of how we perform ablation
- 2) Do we offer it to more patients that we might otherwise not? (older, long-standing AF)
- 3) Define in larger analysis whether dual energy use may be what is ultimately needed for flutter
- 4) Post-ablation anticoagulation needs more data regarding discontinuation
- 5) Concomitant LAAO and ablation is feasible



Systemic thrombolysis (ST) for High-risk PE – not dead yet?

KY ACC 10/2026

George A. Davis, PharmD
Antithrombotic Stewardship
UK HealthCare

22ND ANNUAL MEETING & SCIENTIFIC SESSION



Kentucky
CHAPTER

Disclosures: None

Case

- 28-year-old female presented to community-based hospital ED with acute onset shortness of breath, cyanosis, lightheaded, looking blue around the mouth.
 - PMHx: morbid obesity (BMI 38), GERD, family history of PE, recent bariatric surgery (gastric sleeve/hiatal hernia repair ~2 weeks prior)
 - Notable home meds: estrogen-free, progestin-only oral contraceptive
- Vitals on arrival: HR 180, BP 121/99; RR 41, SpO2 95 on 6L NC on arrival
 - BP became labile dropping to 70s/40s range within 1 hour, started on vasopressor support with response
 - PERTinent labs: troponin T 60, PROBNP 3526, lactate 5.5
 - CTA chest: large bilateral PE with right heart strain
- Started on heparin drip, PERT activated
- PERT recommended emergent ED to ED transfer for higher level of care for high-risk PE with obstructive shock

AHA/ACC Acute PE Clinical Categories

A
Subclinical
Incidental and asymptomatic

B
Symptomatic
Low clinical severity score*

C
Symptomatic
Elevated clinical severity score†

D
Incipient
Cardiopulmonary
Failure

E
Cardiopulmonary
Failure



B1 | Subsegmental
(Single/multiple)

C1 | Normal RV and
normal biomarkers

D1 | Transient
hypotension‡

E1 | Recurrent or
persistent
hypotension with
cardiogenic shock

B2 | Non-subsegmental

C2 | Abnormal RV or ≥1
abnormal biomarker

D2 | Normotensive
shock§

E2 | Refractory
cardiogenic shock
or cardiac arrest

C3 | Abnormal RV and ≥1
abnormal biomarker

+/-
R | Respiratory Modifier
(O₂ <90%, RR ≥30, need
supplemental O₂)

+/-
R | Respiratory Modifier
(>6 L nasal cannula or
use of an NRB mask)

+/-
R | Respiratory Modifier
(Hypoxemic
respiratory failure or
ventilatory failure)

ST recommendations for high-risk PE from clinical practice guideline statements, before 2026...

- **2019 ESC:** “Systemic thrombolysis is recommended for high-risk PE”
- **2020 ASH:** “The ASH guideline panel suggests using systemic thrombolysis over catheter-directed thrombolysis”
- **2021 ACCP** “In people with acute PE who are treated with a thrombolytic agent, systemic thrombolytic therapy using a peripheral vein is recommended over CDT”

Initial Assessment and Management by AHA/ACC Acute PE Clinical Categories

Category A	Category B	Category C1	Category C2	Category C3	Category D1	Category D2	Category E1	Category E2	
Subclinical	Symptomatic, Low Clinical Severity Score	Symptomatic, Elevated Clinical Severity Score	Symptomatic, Elevated Clinical Severity Score	Symptomatic, Elevated Clinical Severity Score	Incipient Cardiopulmonary Failure	Incipient Cardiopulmonary Failure	Cardiopulmonary Failure	Cardiopulmonary Failure	
Initiate DOAC	1	Initiate LMWH					1	Initiate LMWH or UFH	1
Use HESTIA, PESI, and/or sPESI to assess short-term risk	1	Measure at least 1 cardiac biomarker	1						
		Measure lactate							1
		Evaluate RV size and function with CT and/or echo					1	VA-ECMO	2a
Use decision tool to identify suitability for outpatient treatment	2a	Use validated risk score to identify higher-risk patient	2a			Evaluate for normotensive shock	2a		
		Multidisciplinary PERT assessment to guide clinical management							1
							Vasopressor and/or inotropic therapy		1
						Systemic thrombolysis (if acceptable bleeding risk), CDL, or MT in appropriate cases	2b	Systemic thrombolysis (if acceptable bleeding risk), CDL, MT, or surgical embolectomy	2a
								Systemic thrombolysis if acceptable bleeding risk	2a

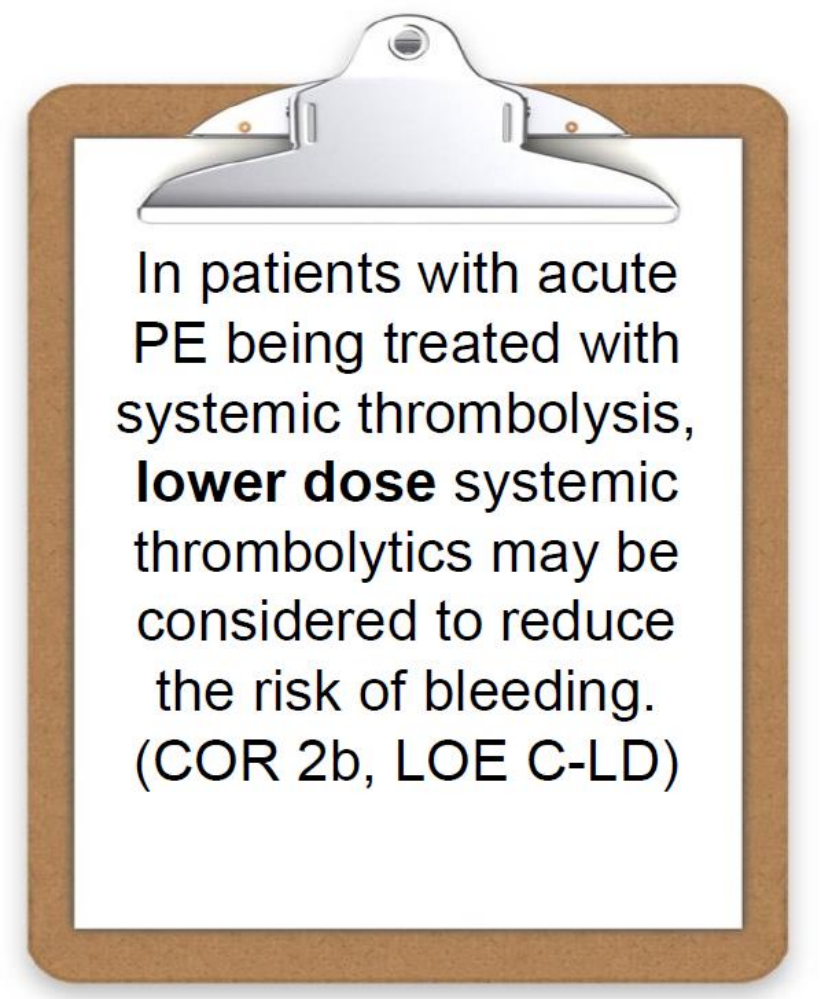
ST remains an option... for the right patient

4.4.1. Systemic Thrombolysis

Recommendations for Systemic Thrombolysis

Referenced studies that support recommendations are summarized in the Evidence Table.

COR	LOE	Recommendations
2a	C-LD	1. In patients with acute PE in AHA/ACC PE Categories E1-2 and acceptable bleeding risk, in whom advanced therapy is being considered, systemic thrombolysis and anticoagulation is reasonable over anticoagulation alone to reduce mortality and recurrent PE. ¹⁻³
2b	C-LD	2. In patients with acute PE in AHA/ACC PE Categories D1-2 and an acceptable bleeding risk, in whom advanced therapy is being considered, systemic thrombolysis and anticoagulation may be considered over anticoagulation alone to prevent further clinical deterioration. ^{1,4}
2b	C-LD	3. In patients with acute PE in AHA/ACC PE Category C3 and acceptable bleeding risk, in whom advanced therapy is being considered, the use of systemic thrombolysis and anticoagulation over anticoagulation alone to prevent further clinical deterioration is uncertain. ^{1,4,5}
2b	C-LD	4. In patients with acute PE being treated with systemic thrombolysis, lower dose systemic thrombolytics may be considered to reduce the risk of bleeding. ⁶⁻¹⁰
3: Harm	B-R	5. In patients with acute PE in AHA/ACC PE Categories A1-C2, systemic thrombolysis should not be used over anticoagulation alone due to increased risk of major bleeding and ICH. ^{5,11,12}



In patients with acute PE being treated with systemic thrombolysis, **lower dose** systemic thrombolytics may be considered to reduce the risk of bleeding.
(COR 2b, LOE C-LD)

2026 AHA/ACC Summary of Advanced Therapy

Recommendations

Table 2. Applying the American College of Cardiology/American Heart Association Class of Recommendation and Level of Evidence to Clinical Strategies, Interventions, Treatments, or Diagnostic Testing in Patient Care* (Updated December 2024)

CLASS (STRENGTH) OF RECOMMENDATION	LEVEL (QUALITY) OF EVIDENCE†
Class 1 (STRONG) Benefit >>> Risk Suggested phrases for writing recommendations: <ul style="list-style-type: none"> Is recommended Is indicated/useful/effective/beneficial Should be performed/administered/other Comparative-Effectiveness Phrases‡: <ul style="list-style-type: none"> Treatment/strategy A is recommended/indicated in preference to treatment B Treatment A should be chosen over treatment B 	Level A <ul style="list-style-type: none"> High-quality evidence‡ from more than 1 RCT Meta-analyses of high-quality RCTs One or more RCTs corroborated by high-quality registry studies
	Level B-R (Randomized) <ul style="list-style-type: none"> Moderate-quality evidence‡ from 1 or more RCTs Meta-analyses of moderate-quality RCTs
	Level B-NR (Nonrandomized) <ul style="list-style-type: none"> Moderate-quality evidence‡ from 1 or more well-designed, well-executed nonrandomized studies, observational studies, or registry studies Meta-analyses of such studies
	Level C-LD (Limited Data) <ul style="list-style-type: none"> Randomized or nonrandomized observational or registry studies with limitations of design or execution Meta-analyses of such studies Physiological or mechanistic studies in human subjects
	Level C-EO (Expert Opinion) <ul style="list-style-type: none"> Consensus of expert opinion based on clinical experience
Class 2a (MODERATE) Benefit >> Risk Suggested phrases for writing recommendations: <ul style="list-style-type: none"> Is reasonable Can be useful/effective/beneficial Comparative-Effectiveness Phrases‡: <ul style="list-style-type: none"> Treatment/strategy A is probably recommended/indicated in preference to treatment B It is reasonable to choose treatment A over treatment B 	
Class 2b (WEAK) Benefit ≥ Risk Suggested phrases for writing recommendations: <ul style="list-style-type: none"> May/might be reasonable May/might be considered Usefulness/effectiveness is unknown/unclear/uncertain or not well-established 	
Class 3: No Benefit (MODERATE) Benefit = Risk (Generally, LOE A or B use only) Suggested phrases for writing recommendations: <ul style="list-style-type: none"> Is not recommended Is not indicated/useful/effective/beneficial Should not be performed/administered/other 	
Class 3: HARM (STRONG) Risk > Benefit Suggested phrases for writing recommendations: <ul style="list-style-type: none"> Potentially harmful Causes harm Associated with excess morbidity/mortality Should not be performed/administered/other 	

AHA/ACC Category	Systemic Lysis	CDL	MT	Surgery	ECMO
A-C1	3-Harm (A)	3-No Benefit (C-EO)	3-No Benefit (C-EO)	3-No Benefit (C-EO)	
C2	3-Harm (B-R)	2B (C-LD - unclear)	2B (C-LD - unclear)	3-No Benefit (C-EO)	
C3	2B (C-LD - unclear)	2B (C-LD - unclear)	2B (C-LD - unclear)	3-No Benefit (C-EO)	
D1-2	2B C-LD – may be considered	2B (B-NR – may be considered)	2B (B-NR - may be considered)	2B (C-LD – unclear)	
E1	2A C-LD	2A (C-LD)	2A (B-NR)	2A (B-NR)	
E2	2A C-LD	n/a	n/a	3-No Benefit (B-NR)	2A (B-NR)



Abbreviations: ACC indicates American College of Cardiology; AHA, American Heart Association; CDL, catheter-directed thrombolysis; and MT, mechanical thrombectomy.

Creager, M.A., et al. 2026 AHA/ACC/ACEP/CHEST/SCAI/SHM/SIR/SVM/SVN Guideline for Evaluation and Management of Acute Pulmonary Embolism in Adults. *Circulation*.

ST Bleeding risk remains a concern

Study	N	Thrombolytic	Comparator	Rate of Major Bleeding
Konstantinides 2002	256	Alteplase 100 mg	Heparin	0.8%
TIPES 2010	58	Tenecteplase 30-50 mg	Heparin	7.1%
Fasullo 2011	72	Alteplase 100 mg	Heparin	5.4%
MOPETT 2012	121	Alteplase 50 mg	Heparin/LMWH	0%
ULTIMA 2013	59	Alteplase up to 20 mg over 16h	Heparin	0%
PEITHO 2014	1005	Tenecteplase 30-50 mg	Heparin/LMWH/ fondaparinux	11.5%
TOPCOAT 2014	83	Tenecteplase (dose ?)	LMWH	0%

Konstantinides S, et al. N Engl J Med, 2002, 347(15):1143-1150.

Becattini C, et al. Thromb Res, 2010, 125(3):e82-e86.

Fasullo S, et al. Am J Med Sci, 2011, 341(1):33-39.

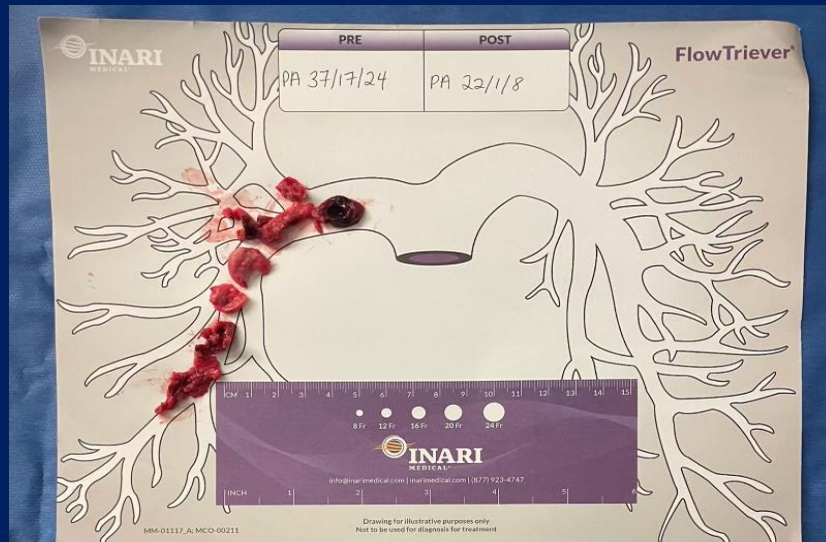
Sharifi M, et al. Am J Cardiol, 2013, 111(2):273-277.

Kucher N, et al. Circulation, 2014, 129(4):479-486.

Meyer G, et al. N Engl J Med, 2014, 370(15):1402-1411.

Kline JA, et al. J Thromb Haemost, 2014, 12(4):459-468.

MT rather convincing visuals, debate over?



Bleed rates

- **CDT: pooled data ICH rate: 5/997, 95% CI 0-1.1%)**
- **CDT: 4.6-5.5% rate of major bleeding, similar to the frequencies reported with full-dose systemic fibrinolysis**
- **Propensity-matched samples from the national Optum[®] database demonstrated an equal 1.9% rate of intracranial hemorrhage (ICH) for CDT and systemic fibrinolysis**

Bloomer TL, et al. Catheterization and cardiovascular interventions 2017;89(4):754-760.

Liu Y, Lu Y, et al. Thromb Res 2014;134(1):50-56

Geller BJ et al. Vasc Med 2020;25(4):334-340.

Alteplase FDA clearance for PE

- 1987 FDA's Cardio-Renal Advisory Panel initially refused to recommend approval for alteplase to treat acute MI; later same year, received approval
 - concern for bleeding risk, too high dosage (150mg), and rethrombosis
 - The Heparin Confound – **high doses of concurrent IV heparin given in early clinical trials**
 - **FDA argued data did not support benefit of alteplase alone**

Alteplase versus heparin in acute pulmonary embolism: randomised trial assessing right-ventricular function and pulmonary perfusion

S.Z. Goldhaber, MD ^a · P.C. Come, MD ^a · R.T. Lee, MD ^a · E. Braunwald, MD ^a · J.A. Parker, MD ^b · W.D. Haire, MD ^c · et al.

Volume 341, Issue 8844, P507-511, February 27, 1993

- 2025 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care: alteplase 50 mg IV bolus during ongoing cardiopulmonary resuscitation 2/2 to PE

Circulation. 2025;152(suppl 2):S578-S672. doi:10.1161/CIR.0000000000001380

- based on observational studies, registry data, case series, limited data

Tenecteplase is not FDA-approved for PE but used off label for PE

Study (N)	Design	PE Population	Mortality, TNK vs Alteplase	Bleeding, TNK vs Alteplase
Murphy 2024 (N=566)	Retrospective registry, propensity-matched	High-risk	30-day mortality: 19.4% vs 19.8%	<10 total events

Murphy LR, et al. *J Emerg Med*. 2024 Nov;67(5):e432-e441.

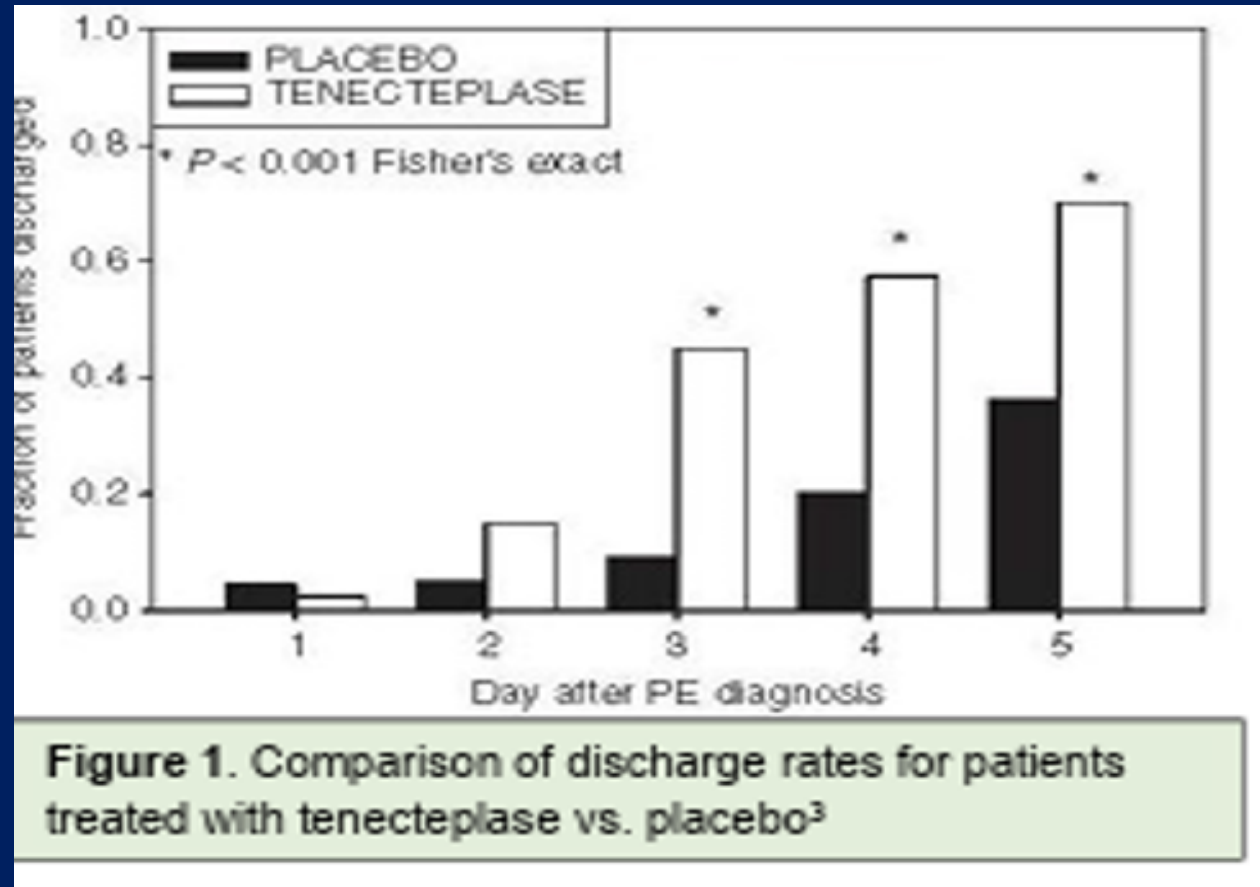
Study	ICH (symptomatic) TNK vs Alteplase (%)	Major Extracranial Hemorrhage
AcT (2022)	3.4 vs 3.2	NR
TRACE-2 (2023)	2.1 vs 1.8	NR
ORIGINAL (2024)	1.2 vs 1.2	NR
ATTEST-2 (2024)	2 vs 2	1 vs 1
TASTE (2024)	3 vs 2	NR

Hagag AM, et al. *Eur J Med Res*. 2025 Aug 8;30(1):726.

PEITHO: Safety outcomes (within 7 days of randomization)

	Tenecteplase (n=506)		Placebo (n=499)		<i>P</i> value
	n	(%)	n	(%)	
Non-intracranial bleeding					
Major	32	(6.3)	6	(1.5)	<0.001
Minor	165	(32.6)	43	(8.6)	<0.001
Strokes by day 7	12	(2.4)	1	(0.2)	0.003
Hemorrhagic	10		1		
Ischemic	2		0		

Lytics impact on discharge (*compared to placebo/AC alone)



J Thromb Haemost 2014 Apr;12(4):459-68.

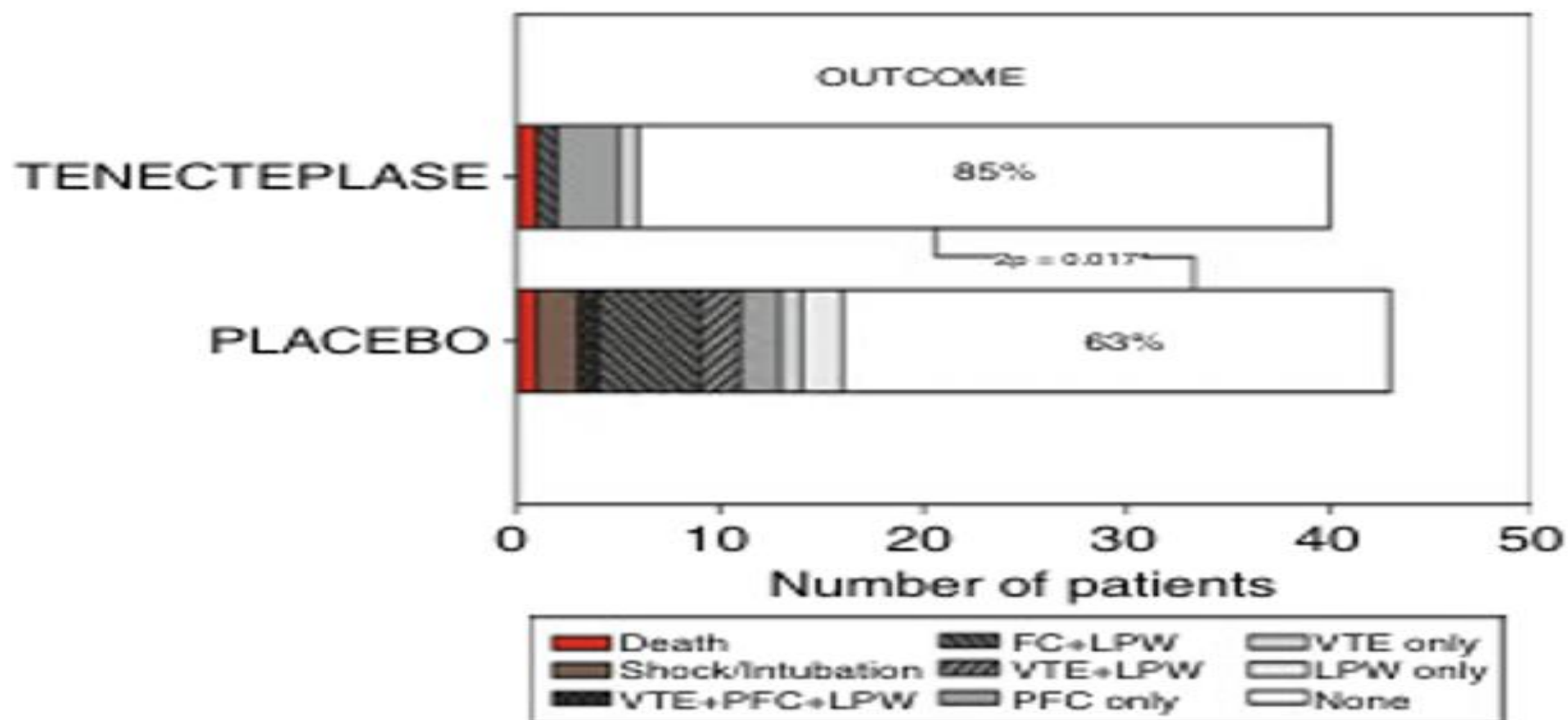


Fig. 2. Bar graph summarizing the main findings. The two-sided P value is from the exact test on independent proportions. $*P = 0.027$ by Fisher's exact. VTE, venous thromboembolism; PFC, poor functional capacity; LPW, low perception of wellness based upon physical component summary score < 30 from the SF-36.



Journal of Clinical Epidemiology 97 (2018) 1–13

**Journal of
Clinical
Epidemiology**

ORIGINAL ARTICLE

Multiple overlapping systematic reviews facilitate the origin of disputes: the case of thrombolytic therapy for pulmonary embolism

Nicoletta Riva^a, Livia Puljak^b, Lorenzo Moja^{c,*}, Walter Ageno^d, Holger Schünemann^c,
Nicola Magrini^c, Alessandro Squizzato^d

- 14 systematic reviews of fibrinolysis in PE
- Agreement: “lysis reduced all cause mortality” (median RR 0.55, IQR 0.48-0.61).
- Disagreement: major bleeding (median RD 4.70%, IQR 0.90%-5.70%)
- Benefit-to-harm ratio was elusive
- Weak inclusion criteria resulted in diverse set of included RCTs.

Thrombolytic product and dosing variance in practice

Thrombolytic Dosing in PE w/Cardiac Arrest	% respondents
Alteplase 50 mg IV bolus over 2 minutes; may repeat in 10-30 minutes if no return of spontaneous circulation	37.4
Tenecteplase 30 to 50 mg IV bolus, based on weight category	23
Alteplase 100 mg IV over 2 hours	9.8
Alteplase ≥ 50 kg: 50 mg; < 50 kg, 0.5 mg/kg; 10 mg IV bolus over 1 minute then remaining dose over 2 hours	8.6
Alteplase 10 mg IV bolus over 1 minute then 90 mg over 2 hours	8.6
Alteplase 100 mg IVP over 2 minutes	6.9
Other	5.7

Rech MA, et al. *Crit Care Explor.* 2020 Jun 9;2(6):e0132.

Why systemic lytics over catheters?

- Proven mortality benefit but bleeding risk remains
- Same level of evidence for intermediate-term outcomes as MT?
- Reduction in VTE recurrence
- Cheaper?
- **AVAILABILITY?**
- Does not preclude other interventions, including MT

Riva N, et al. J Clin Epi 2017.

Marti C, S, et al. EurHeart J 2015;36(10):605-614

Tran A, et al. J Soc Cardiovasc Angiog & Int . DOI: 10.1016/j.jscai.2023.101187.

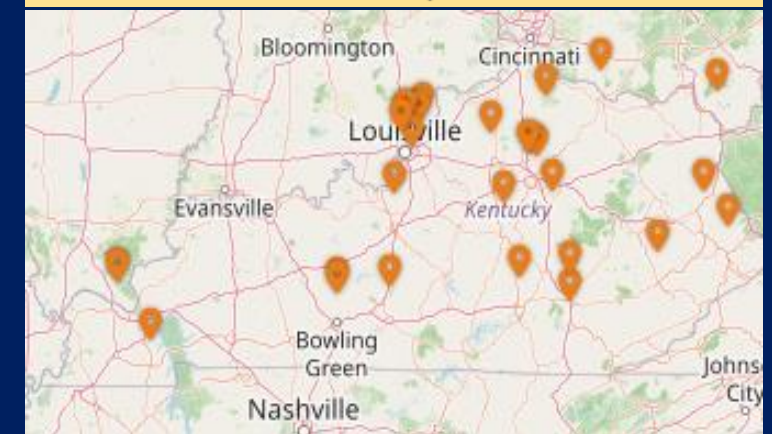
Bunte MC,, et al. Vasc Med 2021;26(1):28-37.

Availability of MT vs ST in rural areas?



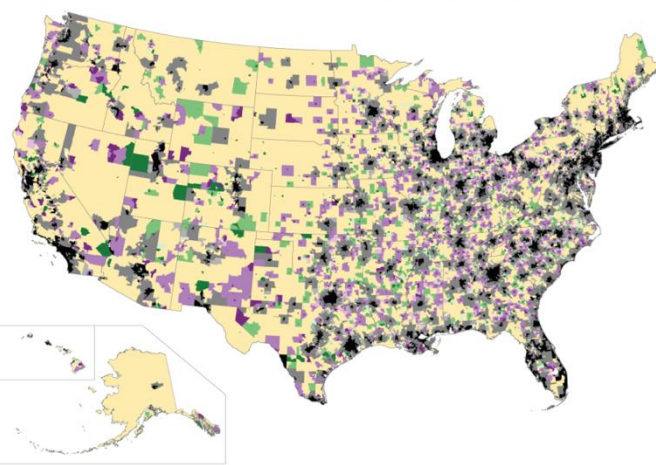
ACC Accredited* Facilities

- ✓ Cardiac Cath Lab
- ✓ Cardiac Cath Lab Outpatient Center with PCI & EP Devices
- ✓ Cardiac Cath Lab with PCI
- ✓ Chest Pain Center with PCI and Shock
- ✓ Chest Pain Center with PCI, Resuscitation, and Shock
- ✓ Chest Pain Center with Primary PCI
- ✓ Chest Pain Center with Primary PCI & Resuscitation



<https://cvquality.acc.org/accreditation/map>

Map of the 2020 Rural-Urban Commuting Area (RUCA) codes

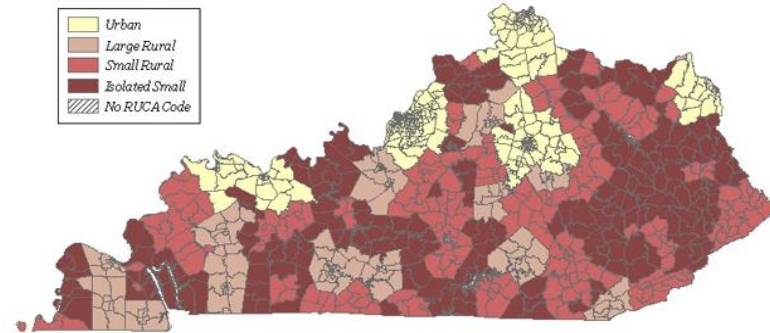
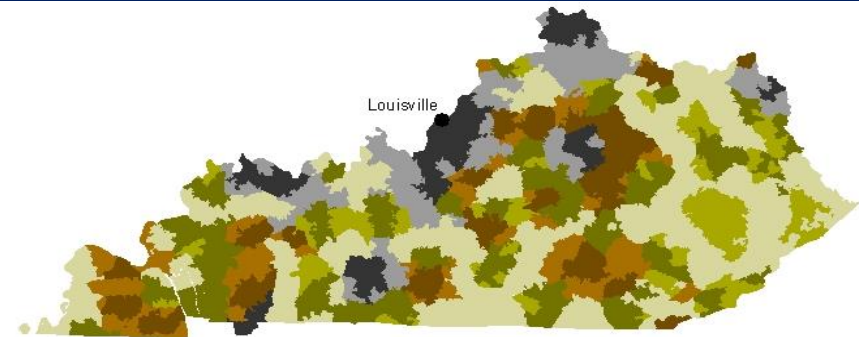


- | | |
|---------------------------------|--------------------------------|
| 1 - Metropolitan core | 6 - Micropolitan low commuting |
| 2 - Metropolitan high commuting | 7 - Small town core |
| 3 - Metropolitan low commuting | 8 - Small town high commuting |
| 4 - Micropolitan core | 9 - Small town low commuting |
| 5 - Micropolitan high commuting | 10 - Rural area |

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Aggregated RUCA Designations by Census Tract

- Urban
- Large Rural
- Small Rural
- Isolated Small
- No RUCA Code



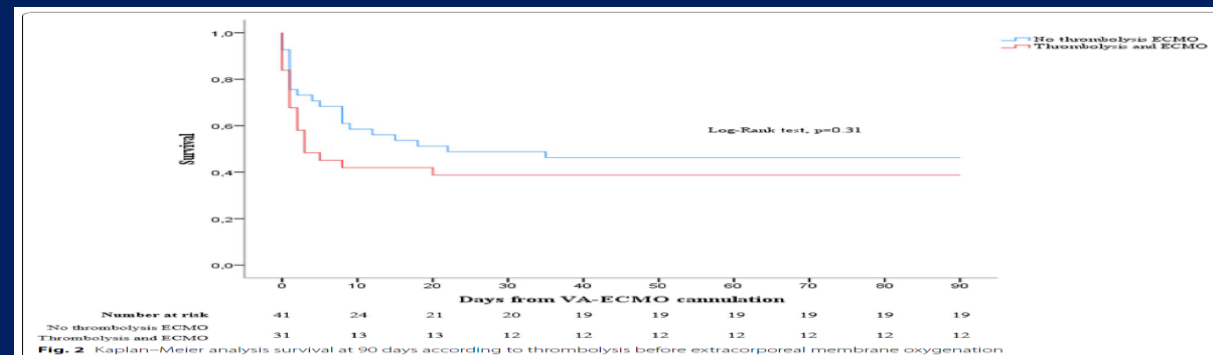
- | | | |
|------------------|-------------------|-------------------|
| Urbanized Area | Large Rural Core | Small Rural Core |
| Other Urban Area | Other Large Rural | Other Small Rural |
| | | Isolated Rural |

Is use of ST a contraindication for other advance PE therapies?

ORIGINAL

Thrombolysis before venoarterial ECMO for high-risk pulmonary embolism: a retrospective cohort study

David Levy^{1,2}, Ouriel Saura^{1,2}, Maria Teresa Passarelli^{2,3}, Manuela Lucenteforte^{2,4}, Guillaume Lebreton^{1,5}, Adrien Bougle⁶, Antoine Monsel^{7,8}, Sofia Ortuno², Yoël Benitha², Nadjib Hammoudi^{1,9}, Benjamin Assouline^{2,10}, Matthieu Petit², Melchior Gautier², Lucie Le Fevre², Marc Pineton de Chambrun^{1,2,11}, Charles Juvin^{1,5}, Juliette Chommeloux^{1,2}, Charles-Edouard Luyt^{1,2}, Guillaume Hékimian^{1,2}, Pascal Leprince^{1,5}, Alain Combes^{1,2} and Matthieu Schmidt^{1,2*}



- n=72 high-risk PE patients on VA-ECMO for 5-7 days
 - n=31 (43%) w/ pre-ECMO ST; n=12/31 (39%) w/ 90-day survival
 - n=41 (57%) w/o pre-ECMO ST; n=19/41 (46%) with 90-day survival

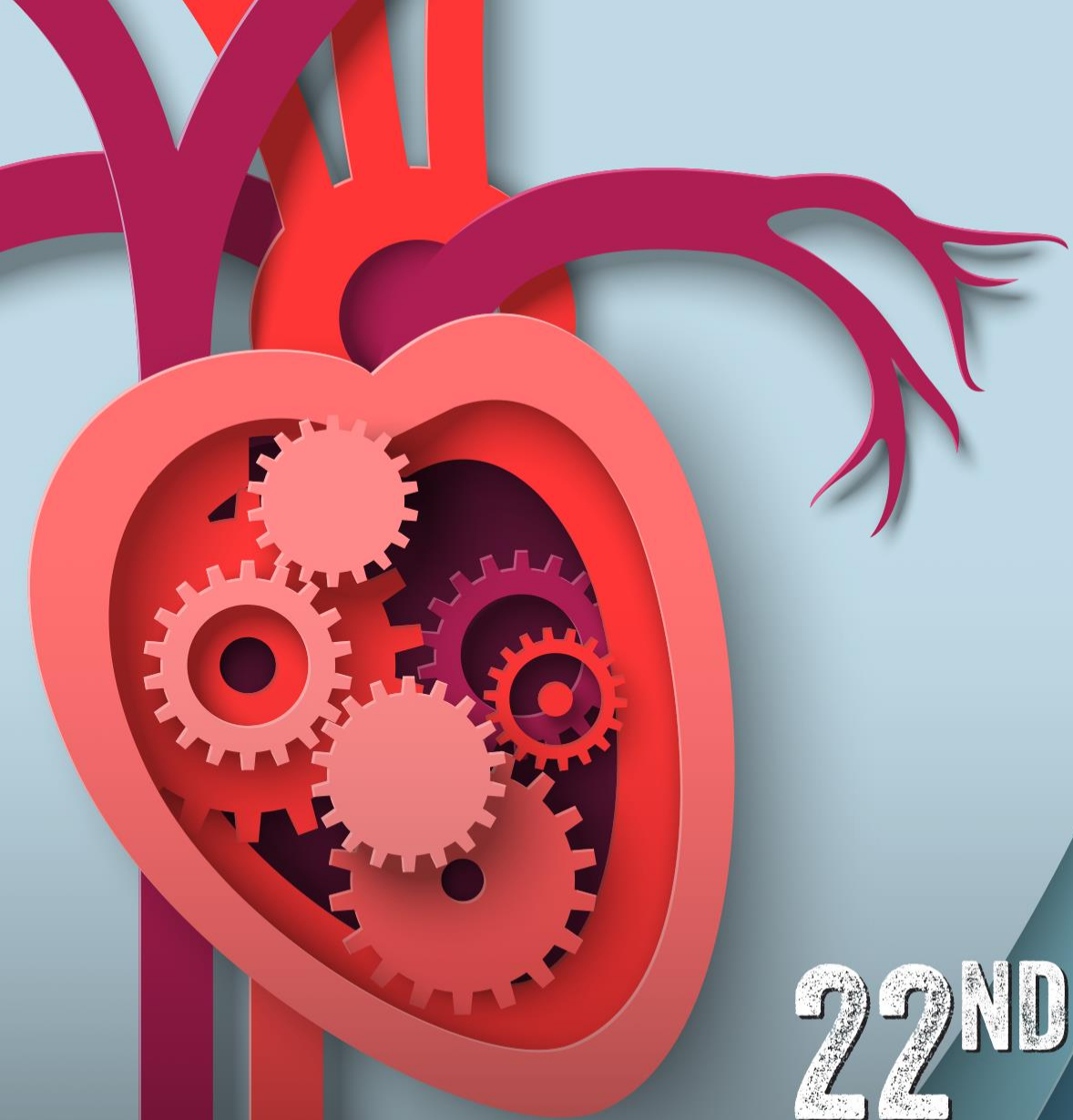
Table 2 ECMO management, complications, and outcomes according to systemic thrombolysis before ECMO

	All patients n = 72	No thrombolysis ECMO (T−) n = 41	Thrombolysis ECMO (T+) n = 31	p value
Inotrope score at ECMO day 1	123 (41–360)	99 (53–365)	138 (26–412)	0.97
SOFA day 1	15 (13–18)	15 (13–18)	15 (13–19)	1
SOFA day 3	14 (11–17)	15 (9–17)	13 (12–17)	0.86
SOFA day 7	11 (7–15)	13 (9–15)	8 (5–14)	0.19
Bleeding complications				
Hemorrhage ≤ GUSTO II	45 (63)	24 (59)	19 (61)	1
Hemorrhage GUSTO I	17 (24)	9 (22)	8 (26)	0.73
Intracranial bleeding	5 (7)	4 (10)	1 (3)	0.38

Summary on systemic lytics

Currently, full-dose thrombolytics are a reperfusion strategy shown in pooled data to have a survival benefit *but we still do not know the optimal dose and which ST product (alteplase vs tenecteplase) debatable*

Thank you!



22ND ANNUAL MEETING & SCIENTIFIC SESSION



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BUSTING CLOTS, NOT VESSELS: EVOLVING ROLE OF CATHETER DIRECTED PE THERAPIES

Ganesh Thirunavukkarasu, MD
Staff Interventional Cardiologist and Vascular Medicine Specialist
Gill Heart and Vascular Institute
University of Kentucky

October 17th, 2026



Disclosures

None



PERT

- In 2012, Kenneth Rosenfield, MD, created the Pulmonary Embolism Response Team (PERT) due to the inability to respond rapidly to patients with pulmonary embolism (PE)
- PE does not have well-known guidelines for treatments options
- PERT leverages the input of a multidisciplinary team of experts and coordinates the care amongst all the services involved with PE; develops protocols for the full range therapies available; and collects data on efficacy

Kenneth Rosenfield, MD, MHCDS >

Section Head, Vascular Medicine
and Intervention, Chairman,
STEMI & Acute MI Quality
Improvement Committee



**“ A good debate can serve
to clarify the key factors that
drive specific decisions or practices,
goal is NOT to pick a winner ”**



Presentation Objectives

01

2026 ACC/AHA Guidelines

Review updated class recommendations for catheter-directed therapy in acute intermediate-high risk PE.

Class IIa Escalation

Bleeding Risk

02

Post-Guideline Trial Data

Evaluate randomized clinical outcomes and safety profiles from groundbreaking 2026 trials.

HI-PEITHO

STORM-PE

PRAGUE-26

03

Catheter therapy in HIGH-risk PE

Demonstrate clinical superiority: rapid RV recovery with minimal ICH risk.

Precision Reperfusion

Safety First



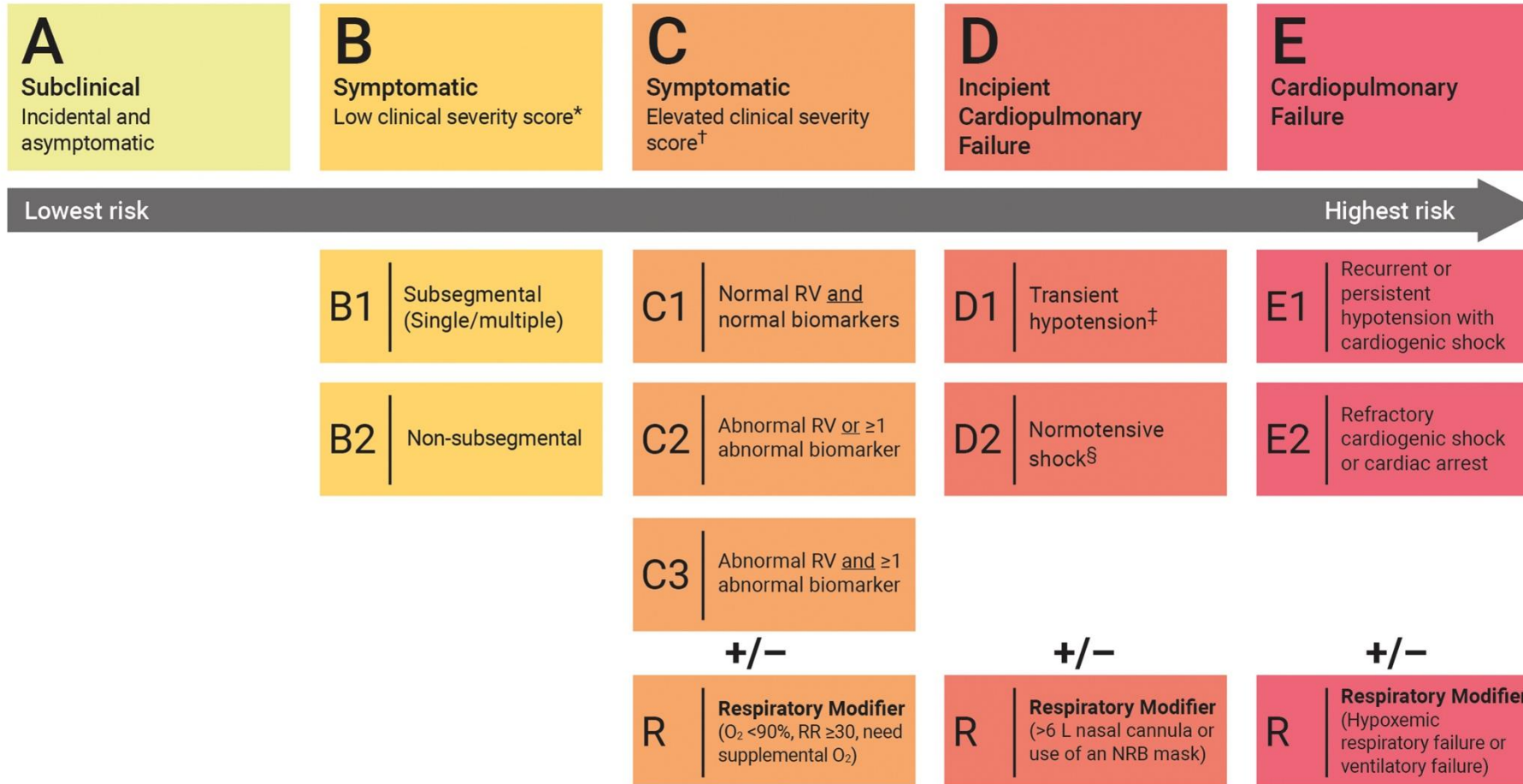
Debate Stance: **Catheter-Directed Therapies** vs. Systemic Thrombolytics

KY-ACC Meeting



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AHA/ACC Acute PE Clinical Categories



2026 Adults With Acute Pulmonary Embolism
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Risk Stratification Crosswalk: ESC 2019 vs. 2026 ACC/AHA

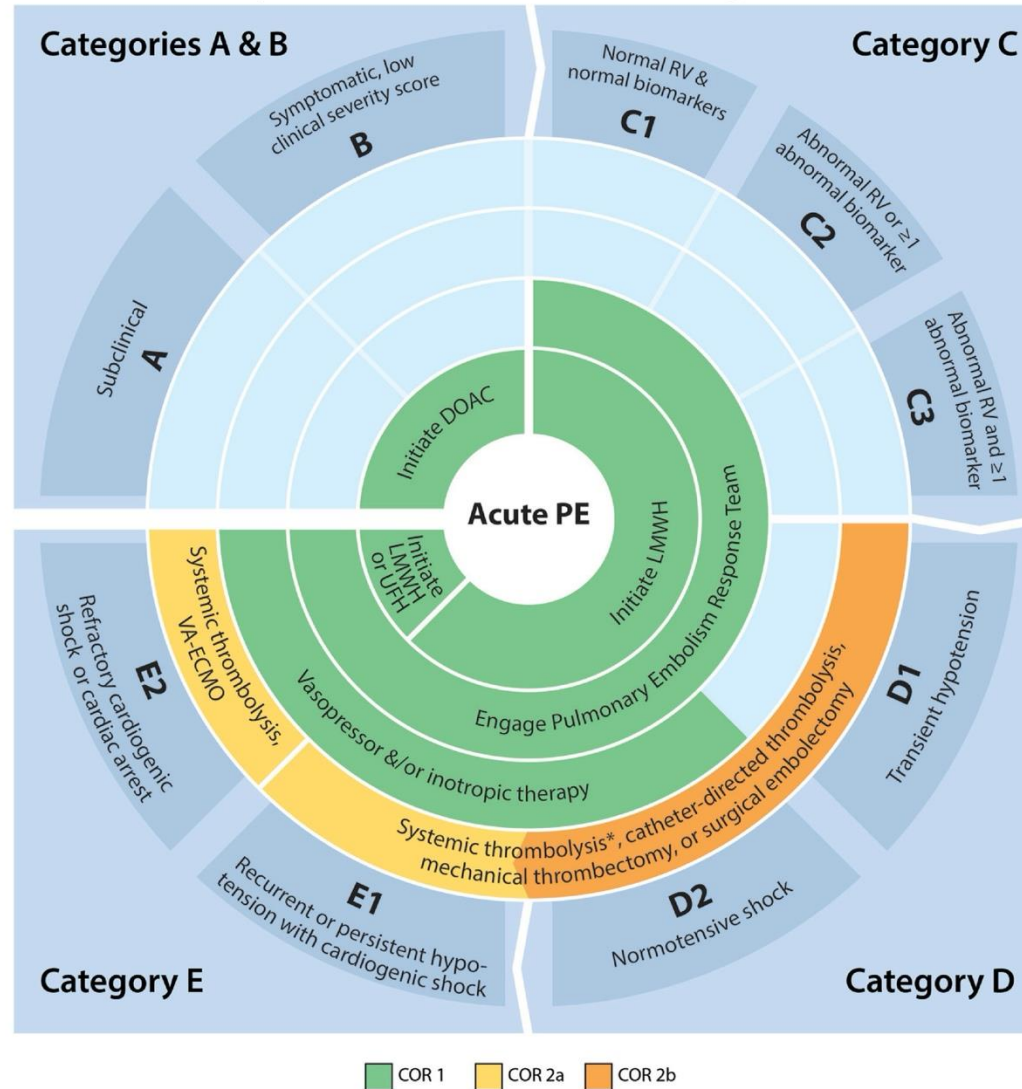
Guideline-Directed Management & Escalation Pathways

ESC 2019 Risk Category	2026 ACC/AHA Class	Guideline Management Recommendations (2026 ACC/AHA)
Low Risk	Category A (Subclinical)	Outpatient management / Early discharge; standard oral anticoagulation.
	Category B (Low Severity)	Inpatient/observation; oral anticoagulation (DOACs preferred); routine monitoring.
Intermediate-Low Risk	Category C1 (Mild Severity)	Standard anticoagulation alone; ward care & routine monitoring.
	Category C2 (Moderate Severity)	Standard anticoagulation; close clinical monitoring for right ventricular failure.
Intermediate-High Risk	Category C3 (High Severity)	Anticoagulation + CDT / Mechanical Thrombectomy evaluation (Class IIa).
	Category D1 (Transient Shock)	Anticoagulation + PERT evaluation; strong consideration for Catheter MT / CDT.
	Category D2 (Normotensive Shock)	Anticoagulation + PERT activation; Catheter MT / CDT recommended (Class IIa).
High Risk / Massively Severe	Category E1 (Persistent Shock)	Systemic Thrombolytics OR Catheter MT (Class IIa) + Pressor/Inotrope support.
	Category E2 (Refractory Shock / Arrest)	VA-ECMO Bridge + Max Pressors + Emergency Catheter MT / Surgical Embolectomy / Lysis.
Key Debate Takeaway: Catheter Interventions		Mechanical Thrombectomy & CDT provide rapid RV unloading with reduced bleeding risk.



CENTRAL ILLUSTRATION: 2026 Acute PE Guideline-at-a-Glance

**Selected Management for Acute PE Patients
by AHA/ACC Clinical Categories**



Dudzinski DM, et al. JACC. 2026;87(13):1620-1625.



Catheter-Directed Thrombolysis and Mechanical Thrombectomy

2a	Percutaneous catheter-directed treatment should be considered for patients with high-risk PE, in whom thrombolysis is contraindicated or has failed.	2a	In patients with acute PE in AHA/ACC PE Category E1, catheter-directed thrombolysis plus anticoagulation is reasonable to prevent further clinical deterioration and early mortality.
		2b	In patients with acute PE in AHA/ACC PE Categories D1-2 in whom advanced therapy is being considered, catheter-directed thrombolysis plus anticoagulation may be considered to prevent further clinical deterioration.
		2b	In patients with acute PE in AHA/ACC PE Categories D1-E1 in whom thrombolysis is being considered, the efficacy of catheter-directed thrombolysis over systemic thrombolysis to reduce short-term fatal/nonfatal clinical deterioration, and improve long-term survival, functional capacity, and quality of life is unclear, but catheter-directed thrombolysis may be considered over systemic thrombolysis to reduce major bleeding risks.
		2a	In patients with acute PE in AHA/ACC PE Category E1, it is reasonable to choose MT plus anticoagulation over anticoagulation alone to prevent further clinical decompensation and acute mortality.
		2b	In patients with acute PE in AHA/ACC PE Categories D1-2 in whom advanced therapy is being considered, MT plus anticoagulation may be considered over anticoagulation alone to prevent further clinical deterioration.
		2b	In patients with acute PE in AHA/ACC PE Categories D1-E1 in whom advanced therapy is being considered, the efficacy of MT to reduce short-term fatal/nonfatal clinical deterioration and improve long-term survival, functional capacity, and quality of life over systemic thrombolysis is unclear, but MT may be considered over systemic thrombolysis to reduce major bleeding risks.

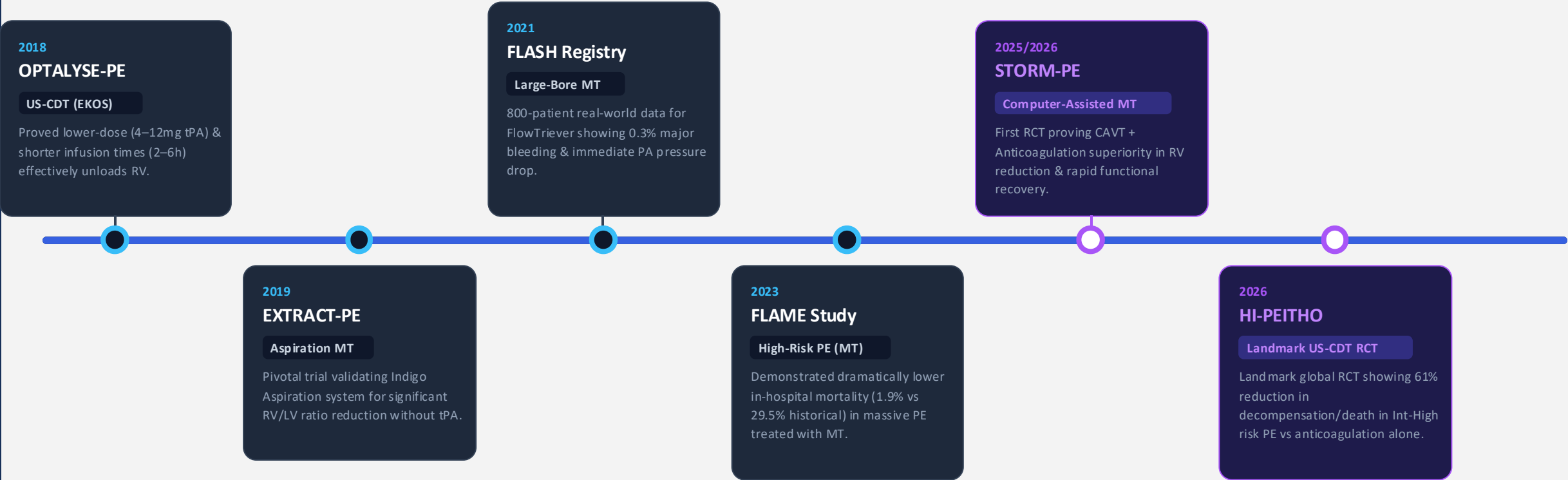


2019 ESC Guideline ²		2026 AHA/ACC/Multisociety Guideline ¹	
COR*	ESC Recommendations	COR*	AHA/ACC/Multisociety Recommendations
Special Considerations			
2b	ECMO may be considered, in combination with surgical embolectomy or catheter-directed treatment, in patients with PE and refractory circulatory collapse or cardiac arrest.	2a	In patients with acute, refractory cardiogenic shock as a result of known or suspected acute PE (AHA/ACC PE Category E2), it is reasonable to institute VA-ECMO, provided appropriate resources are available, to stabilize hemodynamics and improve oxygenation.
		2b	In patients with acute PE in AHA/ACC PE Category E2 who are placed on VA-ECMO support, the usefulness of additional advanced therapies is not well established.
2a	As an alternative to rescue thrombolytic therapy, surgical embolectomy or percutaneous catheter-directed treatment should be considered for patients with hemodynamic deterioration on anticoagulation treatment.	2b	In patients with acute PE in AHA/ACC PE Categories C2-D2 and without contraindications to thrombolysis, and in whom advanced therapy is being considered, the usefulness of either catheter-directed thrombolysis or MT over the other is uncertain for reduction in mortality or major bleeding.
		2b	In patients with acute PE in AHA/ACC PE Categories C2-3, the benefit of catheter-directed thrombolysis plus anticoagulation compared with anticoagulation alone to prevent short-term fatal/nonfatal clinical deterioration, and improve long-term mortality, functional capacity, and quality of life is unclear.
		2b	In patients with acute PE in AHA/ACC PE Categories C2-3, the benefit of MT plus anticoagulation compared with anticoagulation alone is unclear in preventing short-term fatal/nonfatal clinical deterioration and improving long-term survival and functional capacity.
No corresponding guideline recommendation		2a	In patients with acute PE in AHA/ACC PE Categories C3-E2 who have evidence of free-floating right atrial and/or RV clot-in-transit, the utilization of advanced therapies over anticoagulation alone is reasonable to reduce the risk of clinical deterioration.



Major Pulmonary Embolism Clinical Trials Timeline

Evolution from early registries to pivotal RCTs establishing Catheter-Directed Therapies (CDT) & Mechanical Thrombectomy (MT)



● Single-Arm & Prospective Registries (2018–2023)

● Randomized Controlled Trials (2025–2026)

Key Era Shift: From feasibility registries to randomized superiority trials

Landmark Pulmonary Embolism Clinical Trials (2012–2026)

From systemic fibrinolysis and ultrasound-assisted thrombolysis to mechanical thrombectomy and contemporary RCTs.



2012 – 2026 Timeline



Intermediate & High-Risk PE



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Evolution of PE Intervention (2012–2026)

Four major eras defining the shift from systemic lytics to advanced mechanical platforms.

2012–2015

Fibrinolysis & USAT Era

PEITHO, ULTIMA, and SEATTLE II set benchmarks for RV recovery vs bleeding risk.

2016–2018

Low-Dose Refinement

OPTALYSE PE demonstrated safety with lower tPA doses and shorter infusion durations.

2019–2022

Mechanical Emergence

FLARE and FLASH established large-bore mechanical aspiration without thrombolytics.

2023–2026

Head-to-Head RCTs

STAMPEDE, PEERLESS, and HI-PEITHO compare devices directly to standard care.



FLARE (2019) & FLASH (2023)

Validation of mechanical aspiration thrombectomy without thrombolytic agents.

FLARE Trial (2019)

IDE study of FlowTrievery system in 106 intermediate-risk PE patients.

Mean RV/LV ratio reduction of 0.38 at 48 hours with 0.9% major bleeding.

FLASH Registry (2023)

Real-world registry of 800 US and European PE patients treated with aspiration.

Immediate on-table hemodynamic improvement; 1.8% 30-day major adverse events.



HI-PEITHO: Catheter-Directed Lysis in Intermediate-High PE

PRIMARY COMPOSITE ENDPOINT (7 DAYS)

4.0% vs **10.3%** (Control)

61% Relative Risk Reduction in 7-day primary outcome (PE death, decompensation, or recurrence; $p=0.005$).

Safety Profile (30 Days)

Zero Intracranial Hemorrhages observed in both arms. Major bleeding rate (4.1% vs 2.2%, $p=0.32$) showed no statistically significant difference.

Intervention

US-facilitated catheter-directed thrombolysis (EKOS) + low-dose alteplase paired with therapeutic anticoagulation.

Primary Benefit Driver

Significant reduction in **cardiorespiratory decompensation or collapse** (3.7% vs 10.3%), stabilizing patients early.

Clinical Impact

Provides first RCT outcome evidence supporting catheter-directed thrombolysis over anticoagulation alone in intermediate-high risk PE.

STORM-PE: Mech

PRIMARY EFFICACY ENDPOINT (48-HR

0.52

vs 0.24 (0

2.3x Greater RV Strain Reduction at

Clinical Perspective

What Is New?

- STORM-PE (A Prospective, Multicenter, Randomized Controlled Trial Evaluating Anticoagulation Alone Versus Anticoagulation Plus Mechanical Aspiration With the Indigo® Aspiration System for the Treatment of Intermediate High Risk Acute Pulmonary Embolism) represents the first randomized controlled trial to test the efficacy and to evaluate the safety of mechanical thrombectomy with anticoagulation compared to anticoagulation alone for the treatment of intermediate-high risk pulmonary embolism.
- Treatment with mechanical thrombectomy resulted in a significantly greater reduction in right ventricular/left ventricular ratio at 48 hours compared with anticoagulation alone, with comparably low rates of major adverse events in both treatment arms.

What Are the Clinical Implications?

- In this novel international multicenter trial, the use of mechanical thrombectomy produced superior efficacy without an increased relative rate of major adverse events compared with anticoagulation alone, and the procedure was characterized by a high rate of technical success and short device time.
- Mechanical thrombectomy resulted in a superior reduction in right ventricular dysfunction and greater reduction in pulmonary artery obstruction relative to anticoagulation alone.
- Rapidly improved computed tomographic pulmonary angiography parameters achieved with mechanical thrombectomy occurred in conjunction with normalization of patient vital signs and hemodynamics.

Study Device & Design **Lightning Flash**
CAVT Systemchnical success. Minimal blood loss and
olytic drugs.

act

ional recovery and quality of life metrics
management alone. TechnologyComputer-assisted vacuum thrombector
dynamically suction thrombus while mini

PRAGUE-26: Conventional Low-Dose CDT in PE

PRIMARY CLINICAL OUTCOME REDUCTION

Significant

Demonstrated clear reduction in early clinical deterioration and cardiorespiratory collapse versus standard anticoagulation alone.

Safety Observation

No overall increase in total major bleeding, but **2 Intracranial Hemorrhages** occurred in the CDT group vs 0 in anticoagulation alone.

Intervention

Standard (non-ultrasound) catheter-directed low-dose alteplase infusion paired with systemic anticoagulation.

Deterioration Prevention

Treatment effect driven by preventing cardiorespiratory collapse and reducing the need for escalation to systemic thrombolysis or ECMO.

Practice Takeaway

Supports standard CDT as a effective option in experienced PE centers, highlighting the need for careful patient selection given bleeding risks.

SUMMARY

14 Years of Trial Evidence Transformed Acute PE Management

From high-risk systemic lytics (PEITHO) to ultrasound-assisted thrombolysis (ULTIMA) and catheter aspiration (PEERLESS, FLARE, STRIKE, STORM PE), clinical trials have successfully minimized major bleeding while maximizing right ventricular recovery.



Acute Improvements

Safety and Mortality



Pulmonary Embolism: Insights

Immediate intraprocedural hemodynamic and vital sign improvements.

Variable	Preprocedure	Postprocedure	Mean change	P
mPAP, mm Hg	31.5 ± 9.7 (60)	24.3 ± 9.6 (60)	-7.2 (-22.6), 60	<.0001
sPAP, mm Hg	50.7 ± 15.3 (61)	38.3 ± 15.1 (61)	-12.3 (-24.3), 61	<.0001
Mean right atrial pressure, mm Hg	12.8 ± 5.1 (58)	10.6 ± 5.7 (48)	-2.3 (-15.4), 48	<.0001
Systolic blood pressure, mm Hg ^a	116.8 ± 17.7 (60)	121.3 ± 18.8 (60)	4.5 (5.3), 60	.1302
Heart rate, bpm	98.4 ± 19.9 (62)	93.5 ± 17.9 (61)	-4.8 (-3.7), 61	.0091
CI, L/min/m ^{2b}	1.54 ± 0.21 (21)	1.91 ± 0.56 (18)	0.41 (26.5), 18	<.0001
TPVR, mm Hg·min/L	7.3 ± 3.8 (48)	5.3 ± 2.7 (42)	-2.1 (-21.6), 42	<.0001

Highlights

- Mechanical thrombectomy was used for 63 patients
- All patients survived to 48 hours despite presenting with hemodynamic instability
- No major or device-related serious adverse events occurred by 48 hours
- Hemodynamic improvements were demonstrated immediately after thrombectomy
- Echocardiographic, dyspnea, and quality-of-life outcomes improved through 30 days

Abstract

RES

Background:

Hemodynamically **unstable high**-risk, or massive, pulmonary embolism (PE) has a reported in-hospital mortality of over **25%**. Systemic **thrombolysis** is the guideline-recommended treatment despite limited evidence. The ELITE study

Clinical presentation at admission or time of high-risk PE diagnosis

SCAI shock stage*

A	2 (3.8%)	1 (1.6%)
B	11 (20.8%)	6 (9.8%)
C	29 (54.7%)	22 (36.1%)
D	5 (9.4%)	12 (19.7%)
E	6 (11.3%)	20 (32.8%)
Systolic BP, mm Hg	97.4±21.4 n=49	93.5±33.4 n=59
Diastolic BP, mm Hg	65.5±14.7 n=49	57.8±23.5 n=59
Heart rate, bpm	99.9±22.6 n=48	103.1±29.4 n=58
Tachycardia, >100 bpm	29 (54.7%)	34 (55.7%)
Respiration rate, breaths/min	22.2±8.2 n=46	26.0±9.4 n=53
Peripheral O ₂ saturation (SpO ₂), %	95.2±4.7 n=46	92.4±10.0 n=55

System, a significantly lower associated rate of in-hospital adverse clinical outcomes was observed compared with a prespecified performance goal, primarily driven by low all-cause mortality of 1.9%.

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Mechanical Thrombectomy for High-Risk Pulmonary Embolism on Extracorporeal Membrane Oxygenation: A Single-Center Retrospective Case Series

Andrea Gorodezky BS ^a 
Alex J. Solomon MD ^c, Brian

Purpose

To evaluate the use of mechanical thrombectomy (MT) in patients who require venoarterial extracorporeal membrane oxygenation (VA-ECMO) for the management of acute high-risk pulmonary embolism.

D, PhD ^c, James Ronald MD, PhD ^c,

Materials and Methods

This retrospective case series included patients who underwent VA-ECMO followed by MT for the treatment of pulmonary embolism between January 2017 and December 2025. Clinical, laboratory, and imaging data were collected from the electronic medical record. Outcomes included 30-day mortality and procedural adverse events. Potential risk factors for mortality were evaluated. Exploratory analyses between survivors and nonsurvivors were performed using the Mann-Whitney *U* test for continuous variables and Fisher exact test for categorical variables.

Results

A total of 20 patients met inclusion criteria. The mortality rate was 15% (*n* = 3) at 48 hours, 35% (*n* = 7) at 30 days, and 45% (*n* = 9) at 6 months. Procedure-related adverse events were present in 45% (*n* = 9) of patients. Acute bleeding events occurred in 30% (*n* = 6) of patients, and neurologic events occurred in 15% (*n* = 3) of patients following ECMO cannulation and MT. No variables evaluated were significantly associated with mortality.

Conclusions

In this single-center retrospective cohort, patients undergoing MT while supported with VA-ECMO for high-risk pulmonary embolism demonstrated a 30-day mortality of 35%. Further studies including matched controls and larger cohorts are needed to better define the role of MT in this critically ill population.



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