Combined Epicardial and Endocardial Ablation for Atrial Fibrillation: An Updated Best Practices Guide to Hybrid Convergent Procedures

Eldadah, Z.A. et al. (2026). Heart Rhythm O2. https://doi.org/10.1016/j.hroo.2026.07.016

Introduction

Atrial fibrillation (AF) affects more than 10 million people in the U.S., and non-paroxysmal AF remains especially challenging because advanced atrial remodeling limits the effectiveness of standard endocardial ablation.[1] Evidence from randomized trials, including CONVERGE[2], CEASE-AF[3], and HARTCAP-AF[4], supports hybrid epicardial-endocardial ablation as a clinically relevant approach for selected patients with persistent or long-standing persistent AF (LSPAF). An updated best practices guide was written by an international, multidisciplinary group of experts, comprised of highly experienced cardiac electrophysiologists and cardiothoracic surgeons who routinely perform the hybrid convergent procedure. Recommendations were based on the synthesis of published evidence and collective clinical experience.

Hybrid Convergent Team

When making recommendations to screen appropriate candidates for hybrid, a multi-faceted team of experts matters. This team typically consists of an electrophysiologist (EP), cardio-thoracic surgeon, anesthesiologist, advanced practitioner, nurse navigators/coordinators, and other specialists (i.e. heart failure, structural heart disease and bariatric surgery) as applicable. Regular meetings help to streamline communication and reinforce appropriate patient selection, risk-benefit profile, while building patient trust throughout the process.

Patient Selection

Patient characteristics for hybrid convergent ablation are described in table 1. Those who present with symptomatic persistent or LSPAF who have previously failed endocardial catheter ablation and/or are intolerant or refractory to at least one class I and/or III antiarrhythmic drug. Those deemed ‘good’ candidates have symptomatic persistent or LSPAF but also have dilated atria and potentially reversible left ventricular systolic impairment. Candidates deemed marginal typically have other comorbidities (i.e. morbid obesity, severe bi-atrial enlargement, significantly scarred atrial wall) that may preclude them from hybrid treatment.

Procedural Aspects

Performing hybrid convergent on the same day or as a staged procedure varies by institution and procedural logistics. Consult with your local site for their procedure specifics.

Pain Management

Pre- and post-procedural pain management regimens vary by each institution’s standard of care (SOC) protocols. Methods for managing peri- and post-operative pain can involve epidural analgesia, intravenous pain medication and paravertebral blocks. Oral medication including gabapentin, acetaminophen, narcotics, muscle relaxers and anti-inflammatory agents is commonly administered to manage peri- and post-operative pain.

Postoperative Management

Post-operative patient care including time to extubation and ICU length of stay can also vary by each institution’s SOC practice. Protocols to manage pericarditis, fluid management/ drain removal and anticoagulation are also institution dependent. Patients who undergo hybrid convergent need chest tubes to ensure drainage of ablation irrigation fluids. For a sub-xiphoid incision, chest tube removal should align with a low volume of fluid output. For a thoracoscopic approach with a large pericardial incision, chest tube removal can occur on post-operative day (POD) 1, assuming serosanguinous drainage is confirmed. The goal for post hybrid ablation patients is to discharge by POD 2.

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Anticoagulation

While there is not a standardized peri-operative anticoagulation (OAC) protocol for hybrid ablation, practitioners agree on reducing OAC-free periods. Patients on a pre-operative OAC regimen, who stop OAC for epicardial ablation, should minimize their time off OAC post-procedure and consideration of left atrial appendage (LAA) exclusion for some patients is also warranted. During endocardial ablation, the activated clotting time should be maintained above 300s. OAC should be restarted the evening or following day after surgery. OAC should continue without interruption for 60-90 days after both procedures.

Table 1. Patient Candidate Selection for Hybrid Convergent Ablation

Optimal Candidates	Good Candidates	Marginal Candidates
Symptomatic persistent or LSPAF as having failed a previous endocardial catheter ablation and/or are intolerant or refractory to at least one class I and/or III AAD	• Dilated atria • Reversible LV systolic impairment	• Very long history of LSPAF • Morbid obesity (BMI > 40) • Severe bi-atrial enlargement (>6.5cm) • Significant scarred atrial wall • History of cardiomyopathy or mild lung disease • History of thromboembolism with stroke • Prior chest surgery/sternotomy • Prior pericarditis • Low FEV1 • Reduced LV ejection fraction <20% • Frailty or age > 80 years • Dementia Any other concerns which preclude treatment compliance

AAD=antiarrhythmic drug; BMI=body mass index; FEV1=forced expiratory volume in 1 second; LV=left ventricular; LSPAF=long-standing persistent atrial fibrillation

Epicardial Lesion Set

Confirmation of the absence of LAA thrombus is required prior to epicaridal ablation. The total number of epicardial ablation lesions is dependent on patient disease state and atrial size. Most will receive 20-30 ablations for 90s each at 30W. Ablation at each location is repeated once or twice to achieve lesion transmurality. The primary target area for epicardial ablation is the left atrial posterior wall (LAPW). Other areas including the Ligament of Marshall and ganglionated plexi are also more easily accessible with epicardial ablation. Furthermore, because epicardial ablation delivers energy from outside the heart directly into the atrial myocardium, this approach helps reduce the risk of esophageal injury, which can be more problematic with an endocardial approach. Regardless, temperature monitoring during epicardial ablation with the EPi-Sense® device (AtriCure Inc, Mason, OH) should be employed to help avoid thermal esophageal injury.

Endocardial Lesion Set

Following epicardial ablation, endocardial catheter ablation using radiofrequency, cryoballoon or pulsed field ablation (PFA) catheters involve 3-D mapping to identify surviving tissue channels not previously isolated during the epicardial ablation procedure. To mitigate gaps in the lesion set, endocardial lesions should overlap epicardial lesion borders to reduce reconnections in areas prone to edema-related low voltage. Cavotricuspid isthmus ablation is also suggested for patients with typical atrial flutter.

Hybrid Convergent Best Practices

Left Atrial Appendage Closure

The LAA is a primary source of thrombus formation and perpetuation of AF. The contemporary hybrid convergent procedure has evolved to include thoracoscopic surgical LAA exclusion to reduce stroke and thromboembolism risk in patients with AF who remain on OAC. Within a hybrid procedure, the potential benefit and relative risk of LAAE should be evaluated.

Education and Awareness

It is important to align patient expectations with realistic outcomes after hybrid. Patients should be made aware that AF is a progressive disease and AF recurrence between the epicardial and endocardial procedures can happen. Patients should also adhere to post-procedure restrictions until they are cleared to return to normal activity. The primary goal of hybrid convergent is to remain symptom-directed and quality of life-focused.

Follow-up and Clinical Outcomes

For patients who undergo hybrid convergent, routine rhythm monitoring at 3-month intervals at least during the first year and yearly thereafter should be employed.

Future Direction

Even with the recent introduction of PFA, a tissue-selective energy source with a strong safety profile to target LAPW isolation, this method has limitations to achieve transmurality in severely fibrosed LA posterior walls. Therefore, for patients with large atria, LSPAF or prior thermal ablation failures, the hybrid convergent approach remains attractive due to its ability to achieve durable epicardial LAPW isolation and LAA management.

Key Takeaways

- Hybrid epicardial-endocardial (convergent) ablation is a viable option for patients with symptomatic persistent or LSPAF.
- An integrated multidisciplinary team is key to identifying appropriate patients for hybrid along with managing patient expectations, success of treatment, recovery and follow-up.
- Lesions beyond the LAPW and PVs, preferred endocardial energy source, and innovative technology adoption need more evidence to drive consensus.

References

[1]Eldadah, Z.A., Celentano, E., Buch, E.F. et al. (2026). Endocardial Ablation for Atrial Fibrillation: An Updated Best Practices Guide to Hybrid Convergent Procedures. Heart Rhythm O2. https://doi.org/10.1016/j.hroo.2026.07.016

[2]Delurgio, D.B., Crossen, K.J., Gill, J. et al. (2020). Hybrid Convergent Procedure for the Treatment of Persistent and Long-Standing Persistent Atrial Fibrillation: Results of CONVERGE Clinical Trial. Circ Arrhythm Electrophysiol.13:e009288. DOI: 10.1161/CIRCEP.120.009288

[3]Doll, N., Weimar, T. Kosior, D.A. et al. (2025). Durable effectiveness and safety of hybrid ablation versus catheter ablation: 2-year results from the randomized CEASE-AF trial. Eur J Cardiothorac Surg. DOI:10.1093/ejcts/ezaf146

[4]van der Heijden, C.A., Weberndorfer, V., Vroomen, M. et al. (2023). Hybrid Ablation Versus Repeated Catheter Ablation in Persistent Atrial Fibrillation: A Randomized Controlled Trial. JACC Clin Electrophysiol. 9(7 Pt 2):1013-1023. DOI:10.1016/j.jacep.2022.12.011.

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Hybrid Convergent Best Practices

EPi-Sense Coagulation System/EPi-Sense ST™ Coagulation Device Indications

U.S. Indications: EPi-Sense Coagulation System/EPi-Sense ST™ Coagulation Device is intended for the treatment of symptomatic long-standing persistent atrial fibrillation (continuous atrial fibrillation greater than 12 months duration) when augmented in a hybrid procedure with an endocardial catheter listed in the instructions for use, in patients (1) who are refractory or intolerant to at least one Class I and/or III antiarrhythmic drug (AAD); and (2) in whom the expected benefit from rhythm control outweighs the potential known risks associated with a hybrid procedure such as delayed post-procedure inflammatory pericardial effusions. Contraindications include patients with Barrett's Esophagitis, left atrial thrombus, a systemic infection, active endocarditis, or a localized infection at the surgical site at the time of surgery. Adverse Events: Reported adverse events associated with epicardial ablation procedure may include, but are not limited to, the following: pericardial effusion/cardiac tamponade, pericarditis, excessive bleeding, phrenic nerve injury, stroke/TIA/neurologic complication. Warnings: Physicians should consider post-operative anti-inflammatory medication to decrease the potential for post-operative pericarditis. and/or delayed post-procedure inflammatory pericardial effusions. Physicians should consider post-procedural imaging (i.e. 1-3 weeks post-procedure) for detection of post-procedure inflammatory pericardial effusions. Precautions: Precautionary measures should be taken prior to considering treatment of patients: (1) Deemed to be high risk and who may not tolerate a potential delayed post-procedure inflammatory pericardial effusion. (2) Who may not be compliant with needed follow-ups to identify potential safety risks. To ensure patients undergoing treatment with the EPi-Sense/EPi-Sense ST device are well informed, the benefits, potential risks and procedural outcomes associated with the EPi-Sense/EPi-Sense ST Hybrid Convergent procedure should be discussed with the patient. Physicians should document accordingly in the medical record. Qualified operators are physicians authorized by their institution to perform surgical sub-xyphoid pericardial access. The coagulation devices should be used by physicians trained in the techniques of minimally invasive endoscopic surgical procedures and in the specific approach to be used. Operators should undergo training on the use of EPi-Sense/EPi-Sense ST device before performing the procedure. Safety and effectiveness of concomitant left atrial appendage closure was not evaluated in the CONVERGE study. Follow-up should be conducted at approximately 30 days post procedure to monitor for signs of delayed onset pericarditis or pericardial effusion.

Australia, Brazil, Canada, Chile, EU Region, Hong Kong, Malaysia, Taiwan, UK: The EPi-Sense Coagulation Device is indicated for epicardial treatment of atrial fibrillation, including when augmented with an endocardial ablation, with the aim to restore normal sinus rhythm (i.e., freedom from AF/AFL/AT), reduce AF symptoms, and improve quality of life.

Australia, Chile, EU Region, Hong Kong, Israel, New Zealand, UK indications: The EPi-Sense ST device is indicated for the epicardial treatment of atrial fibrillation, including when augmented with an endocardial ablation, with the aim to restore normal sinus rhythm (i.e., freedom from AF/AFL/AT), reduce AFIB symptoms, and improve quality of life.
Brazil, Canada Indications: The EPi-Sense Coagulation Device is indicated for epicardial treatment of longstanding persistent atrial fibrillation, including when augmented with an endocardial ablation, with the aim to restore normal sinus rhythm (i.e., freedom from AF/AFL/AT), reduce AF symptoms, and improve quality of life.