

CLINICAL WORKFLOW AND APPLICABILITY OF EP CARDIOVASCULAR MAGNETIC RESONANCE-GUIDED RF ABLATION OF ISTHMUS-DEPENDENT ATRIAL FLUTTER

Objective: To determine safety and efficacy of electrophysiological cardiovascular magnetic resonance (EP-CMR)-guided radiofrequency (RF) ablation in patients with typical right atrial flutter in a routine clinical setting.

METHODS

30 patients with typical right atrial flutter underwent clinically indicated EP-CMR-guided cavotricuspid isthmus ablation.

- EP-CMR protocols included pre- and post-ablation CMR imaging (whole heart, T2-weighted, and early-/late-gadolinium enhancement) together with electroanatomic mapping of the right atrium.
- Coronary sinus cannulation time and total ablation procedure duration were used as performance measures to determine the learning experience of the EP-CMR interventionalist and for comparison with conventional, fluoroscopy-guided atrial flutter ablation.
- Procedural safety and success rates were evaluated at the 7-day and 3 months follow-up.

STUDY ENDPOINTS

Primary Acute Performance: Acute success defined as the demonstration of bidirectional cavo-tricuspid isthmus block after radiofrequency application in the cavo-tricuspid isthmus.

Primary Chronic Performance: Chronic success defined as freedom from recurrence of type 1 atrial flutter at 3-months post procedure.

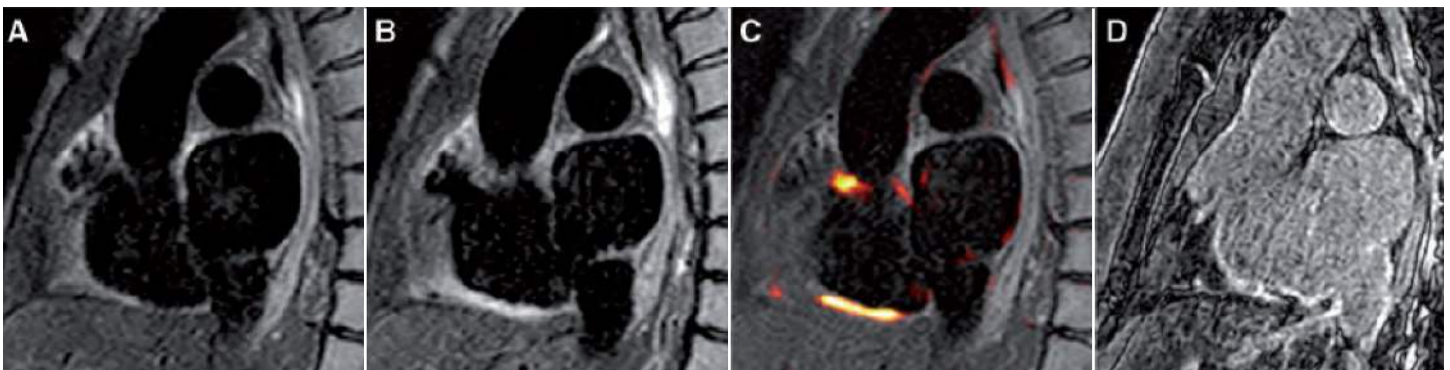
Primary Safety: The rate of serious adverse events (SAEs) related to the device or procedure assessed at the 7-day follow-up.

RESULTS

Primary success rate of EP-CMR ablation was 93% (28/30); complete bi-directional isthmus block could not be established in 2 out of 30 patients by EP-CMR alone and needed 117s and 188s of additional fluoroscopy-guided RF ablation assisted by a steerable sheath, respectively.

Primary Chronic Performance: During the 3 month follow-up period, none of the patients had documented recurrence of atrial flutter (0% recurrence rate)

Primary Safety: After 7 days, no serious adverse events related to the ablation catheter or procedure were reported.



Pre- and post-ablation CMR imaging for tissue characterization of radiofrequency-induced ablation lesions. (A) Pre-ablation T2-weighted black-blood CMR imaging of cavotricuspid isthmus; (B) post-ablation T2-weighted black-blood imaging in identical scan geometry; (C) subtraction image of pre- and post-ablation T2 signal intensity measurements with anatomical image fusion for clear demarcation of post-ablation oedema; (D) high-resolution, late-gadolinium enhancement CMR imaging (identical scan geometry).

Conclusion: In a routine clinical setting, EP-CMR-guided RF ablation proved safe and effective for the treatment of typical right atrial flutter. Its performance and outcomes were comparable to those of conventional fluoroscopy-guided ablation, supporting EP-CMR as a valid alternative approach.

MAGNETIC RESONANCE IMAGING-GUIDED CONVENTIONAL CATHETER ABLATION OF ISTHMUS-DEPENDENT ATRIAL FLUTTER USING ACTIVE CATHETER IMAGING

Objective: To explore the safety, feasibility, and efficacy of CTI ablations performed completely in the iCMR suite using active catheter imaging.

METHODS

15 consecutive patients underwent iCMR-guided catheter ablation for CTI-dependent atrial flutter.

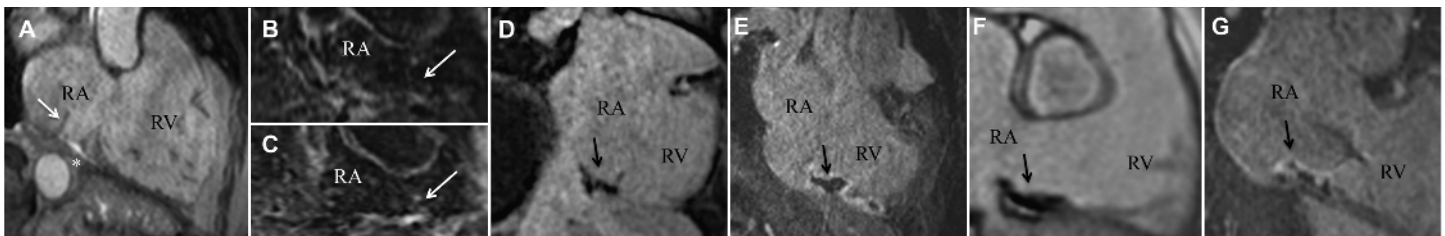
- Procedures were performed in a 1.5-T magnetic resonance (MR) imaging unit with MR-conditional ablation catheters.
- Catheter guidance was achieved using active catheter imaging via integrated MR receive tip coils.
- Acute success, periprocedural complications, and short-term follow-up were collected for further analysis.

RESULTS

All patients (N=15; 73% male; median age 70 years; interquartile range [67–82]) achieved acute procedural success without any complication. Median procedural time was 43 minutes [33–58] with median radiofrequency delivery time of 18 minutes [12–26].

Postprocedural lesion visualization scanning was completed in a median of 32 minutes [10–42].

None of the patients with 6-month follow-up had atrial flutter recurrence.



Acute lesion after radiofrequency ablation of the right cavotricuspid isthmus. A: Balanced steady-state free precision sequence image of the cavotricuspid isthmus (CTI) immediately after ablation. White asterisk indicates pericardial effusion. White arrow indicates a prominent eustachian valve. B, C: T2-weighted images preablation (B) and postablation (C) showing signal intensity enhancement of the isthmus line (white arrows). D: Noncontrast enhanced T1-weighted image of the CTI depicts acute necrotic lesions as signal intensity loss (black arrow). Inversion time was adjusted to suppress the acute lesion. E: Postcontrast early enhancement image shows hypoenhanced myocardium localized at the CTI, known as a microvascular obstruction as an acute ablation lesion sign. F: Phase-sensitive inversion recovery image depicts acute ablation lesion in terms of black, hypoenhanced myocardium. G: Postcontrast late gadolinium enhancement images led to partially enhanced radiofrequency ablation lesions (white edge) with black necrotic core (black arrow).

Conclusion: In the iCMR suite, CTI-dependent atrial flutter ablation could be achieved safely using active catheter imaging without any complication. It further allows detailed anatomic visualization of the CTI, intraprocedural lesion visualization, and exclusion of pericardial effusion.

SAFETY, EFFICACY, AND 2-YEAR OUTCOMES OF CARDIOVASCULAR MAGNETIC RESONANCE-GUIDED ABLATION OF ISTHMUS-DEPENDENT ATRIAL FLUTTER

Objective: Cavotricuspid isthmus (CTI)-dependent atrial flutter ablation with interventional cardiovascular magnetic resonance (CMR) has demonstrated safety and efficacy for achieving bidirectional block. However, limited long-term follow-up data exist for these patients.

METHODS

Thirteen consecutive CTI-dependent atrial flutter patients that underwent CMR-guided catheter ablation procedures between 2021 and 2022 were included (see table 1 for patient characteristics). Patients were ablated under conscious sedation within the CMR environment and were followed for a median of 27 months (IQR: 27-29).



RESULTS

Eleven of the 13 patients (85%) had block successfully achieved under CMR (see table 2 for parameters). The CTI ablation had to be completed in a conventional electrophysiology laboratory for 2 patients: one required general anesthesia due to pain during CTI ablation, and the other deteriorated into atrial fibrillation during the ablation procedure.

Among the 11 patients with procedural success, 2 (18%) were lost to follow-up. The remaining 9 (82%) were free of recurrent isthmus-dependent atrial flutter at a median follow-up of 27 months (IQR: 24-29).

TABLE 1 Patient Characteristics (N=13)

Age, y	76 (73-78)
Male	8 (62)
Heart disease	
None	6 (46)
Ischemic	2 (15)
Valvular heart disease	4 (31)
Myocarditis	1 (8)
LVEF, %	60 (60-60)
Antiarrhythmic Drugs	
None	3 (23)
Beta-blockers	5 (38)
Amiodarone	5 (38)
Flecainide	3 (23)
Values are median (IQR) or n (%).	
LVEF = left ventricular ejection fraction.	

TABLE 2 Cavotricuspid Isthmus Ablation Parameters and Follow-Up

Interventional procedure duration, min	60 (60-120)
Total radiofrequency pulse duration, s	478 (206-577)
Obtention of bidirectional isthmus block, %	11 (85)
Double potentials, ms	90 (77-120)
Procedural complications	
Pericardial effusion/tamponade	0 (0)
Vascular complications	0 (0)
Thromboembolic events	0 (0)
Outpatients	13 (100)
Lost to follow-up	2 (18)
Follow-up, mo	27 (24-29)
Recurrence of isthmus-dependent atrial flutter	0 (0)
Values are median (IQR) or n (%).	

Conclusion: iCMR-guided ablation of CTI-dependent atrial flutter demonstrates a good safety profile and efficacy at 2-year follow-up.