Letter to the Editor

Ablation of Cavotricuspid Isthmus-Dependent Flutter Using a Mini-Electrode–Equipped 8-mm Ablation Catheter: Case Series

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Catheter ablation is the treatment of choice for the prevention of recurrences and the long-term management of patients with cavotricuspid isthmus (CTI)-dependent atrial flutter. In current clinical practice, CTI ablation is performed with the use of large-tip or irrigated ablation catheters, since they have been shown to reduce the procedure duration and to increase the success rate as compared to the use of a standard 4-mm ablation catheter.[1]

A limitation of the large-tip ablation catheter is the impaired near-field electrogram resolution.[2] A novel catheter technology designed to address this issue includes the embedment of mini-electrodes (ME) in close proximity to the edge of large-tip ablation catheters. Electrical activity recorded from the MEs, in contrast to the conventional bipolar recording, may provide improved spatial resolution, detailed and more accurate localization of the catheter tip, as well as reliable guidance for the titration of the radiofrequency energy delivered.[3,4] Gupta et al have reported a case where this novel ablation catheter was used successfully for ablation of a gap in a previously deployed linear lesion across the CTI in a patient with recurrent atrial flutter.[5]

In the present study, we aimed to evaluate the efficacy and safety of this novel ablation catheter in a small series of consecutive patients with CTI-dependent atrial flutter.

Methods

The ablation catheter used in all ablation procedures (IntellaTip MiFi XP; Boston Scientific) is an 8-mm ablation catheter with three MEs (diameter 1.2 mm) equally spaced in a radial array (every 120°), embedded at a distance of ~2 mm from the catheter tip. The MEs are insulated from the 8 mm bipolar electrode by a surrounding sleeve, providing dielectric isolation. Distinct local electrograms can be recorded by the MEs in either a unipolar or a bipolar configuration.

Ablation was performed under therapeutic doses of oral anticoagulants, or following cessation of oral anticoagulant treatment and bridging with subcutaneous low molecular heparin. During the procedure, a deflectable decapolar diagnostic catheter was positioned in the coronary sinus and a quadripolar catheter was placed in the right ventricle. If the patient was in sustained atrial flutter, the CTI dependence of the underlying reentry circuit was validated using the standard electrophysiological criteria of entrainment during pacing from the CTI and the proximal bipole of the coronary sinus catheter. If the

patient was in sinus rhythm, ablation was performed under pacing from the proximal bipole of the coronary sinus catheter.

The ablation catheter was advanced into the right ventricle, close to the tricuspid valve annulus. An ablation line was deployed from the tricuspid valve annulus to the inferior vena cava along the central isthmus (6 o'clock in left anterior oblique projection). Radiofrequency energy was applied either intermittently or continuously during catheter dragging, depending on physician preference and anatomic peculiarities. Ablation was performed using a maximal power of 70W and maximal temperature of 65°C.

The ablation endpoint was achievement of bidirectional CTI block persisting during a 20-minute waiting period. The following electrophysiological criteria were used for documentation of bidirectional CTI block: differential pacing maneuvers;[6] presence of widely split double potentials along the ablation line;[7] and assessment of the atrial activation sequence and measurement of ablation-induced prolongation in transisthmus intervals, during pacing from the coronary sinus ostium and low lateral right atrium.[8]

Monitoring of arrhythmia recurrence was performed using 24-hour Holter monitoring three months post-ablation and/or by a 12-lead surface ECG in case of symptomatic arrhythmia.

Results

Our case series included seven consecutive patients (mean age 66.7 ± 11.4 years, 5 men) with CTI-dependent flutter and no evidence of structural heart disease, who underwent catheter ablation in our department. One case was a redo procedure performed 6 months following the initial ablation procedure. Monitoring of bipolar electrograms recorded by the MEs enhanced accurate localization of the catheter tip, primarily at the ventricular and the inferior vena caval edge of the ablation line, and facilitated validation of conduction block (Figures 1 & 2).

CTI bidirectional block was achieved in all patients following a mean number of 8.9 ± 5.4 lesions with a mean ablation time of 409 ± 227 s. Mean procedure duration was 59.5 ± 20.1 min and mean fluoroscopy dose was 45.8 ± 23.4 Gy.cm^2. During the post-ablation validation of CTI bidirectional block, the mean transisthmus intervals during pacing from the coronary sinus ostium and low lateral right atrium were 141 ± 28.9 ms and 141 ± 23.5 ms respectively.

In our case series, no procedural complications occurred and the in-hospital course of all patients was uneventful. During a mean follow-up period of 195 ± 27 days, one patient presented recurrence of CTI flutter documented by 12-lead ECG.

Discussion

In the present study we report the feasibility of radiofrequency catheter ablation of CTI-dependent flutter in a series of seven consecutive patients, with the use of a novel 8-mm non-irrigated catheter equipped with three radially distributed MEs, embedded near the catheter tip. To our knowledge this is the first case series of CTI ablation using this novel catheter technology. Ablation procedures were performed by three consultant electrophysiologists, without prior specific training in this novel catheter technology. In all cases, bidirectional CTI block was achieved without associated complications. The procedural characteristics in our case series were comparable to those of previous trials reporting data on the use of conventional 8-mm tip catheters in CTI flutter ablation (Table 1). It is worth noting that the total duration of radiofrequency applications in our case series was the lowest when compared to previous trials. However, this is a hypothesis-generating finding and needs to be validated by future, adequately powered studies with direct head-to-head comparison of different ablation catheters.

Previous experience in experimental models

This novel catheter has been reported to display enhanced spatial resolution in experimental models. In an experimental model of myocardial infarction in swine, the ME-equipped catheter facilitated the identification of late potentials in ischemic ventricular scar, which could not be detected by the standard 4 mm bipolar electrode.[9] It has also been shown to improve the resolution of mapping of complex fractionated atrial electrograms during atrial fibrillation.[10] In addition, lesion formation resulted in a significantly greater reduction in electrogram amplitude and maximum frequency in bipolar ME as compared to a conventional tip-to-ring configuration.[2] Thus, monitoring of electrogram amplitude and frequency has been proposed as a surrogate of effective lesion deployment.