

# Radiofrequency catheter ablation as a first procedure for atrial flutter treatment

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## Introduction

The common atrial flutter is maintained by a counterclockwise or clockwise macroreentrant circuit in the right atrium which can be effectively treated by radiofrequency ablation of the inferior vena cava - tricuspid annulus isthmus. Radiofrequency catheter ablation has replaced antiarrhythmic-drug therapy for the treatment of many types of cardiac arrhythmias due to a favorable risk-benefit ratio.

Nowadays, radiofrequency ablation is accepted as an appropriate first-line therapy in patients presenting paroxysmal supraventricular tachycardia related to an accessory-pathway or atrioventricular nodal reentrant tachycardia. However, despite the high success rate of radiofrequency ablation, pharmacological therapy is still considered the standard initial therapeutic approach for atrial flutter. Our objective in this section is to review the evidences supporting the point of view that common atrial flutter should be included in the group of tachycardias that RF ablation might be considered as first-line therapy for its effectiveness.

## Background

Radiofrequency is the most widely used and effective form of energy applied during catheter ablation. It is an alternating current delivered at cycle lengths of 300 to 750 kHz that causes resistive heating of the tissue in contact with the electrode. The power of RF pulses is typically controlled by the catheter tip temperature and system impedance. Most ablation catheters have a 4-mm distal electrode and create lesions approximately 4 to 6 mm in diameter and 2 to 3 mm deep. Larger electrodes (8 -10 mm) or saline irrigated ablation catheters produce larger lesions. The acute lesion created by radiofrequency current consists of a central zone of coagulation necrosis surrounded by a zone of inflammation. Chronic lesions are characterized by coagulation necrosis with a very well defined border. Good electrode contact with target tissue is essential to perform definitive lesions. Unstable catheter positions and changes on the lesion border zone explain why arrhythmias may recur after apparently successful ablations.

Once the critical isthmus of common flutter is located between the inferior vena cava and tricuspid annulus all techniques applied for flutter ablation are based on creation of a line of conduction block connecting such structures to interrupt that macroreentrant circuit.

In the last years there has been important improvements in the atrial flutter ablation technique. First, related to more efficient methods to confirm that isthmus bi-directional conduction block has been obtained and second, increasing the effectiveness of the radiofrequency application to obtain a complete line of block, consequently reaching a higher rate of bi-directional block in the isthmus and decreasing atrial flutter recurrence during follow-up. After radiofrequency ablation, bi-directional conduction block in the isthmus is usually evaluated through a multipolar (deca or duo decapolar) catheter positioned around the tricuspid annulus. Obtaining double potentials separated by an isoelectric interval along the line of block is a simplified electrophysiological strategy to demonstrate transmural lesion in the isthmus [Shah DC et al *Circulation*. 1997;96:2505-8]. An interval separating the two components < 90 ms was always associated with a local gap, whereas a double potential interval > 110 ms was always associated with bi-directional conduction block. A double potential > 90 ms with maximum variation of 15 ms between double potentials along the ablation line was also related to bi-directional block [Tada H J *Am Coll Cardiol* 2001;38:750-5]. High power RF pulses applied through 8-mm-tip or irrigated-tip are more effective to obtain isthmus bi-directional block when compared to regular tip, with lower recurrence rate and rare complications [Marrouche NF *PACE* 2003;26:743-6]. Thus, applying the present technology, atrial flutter can be effectively and safely treated in most patients.

## Recent data of flutter ablation

The results using the standard anatomic approach with regular catheters have shown that early success rate of flutter radiofrequency ablation is high and the recurrence rate is from 10 to 27 percent depending on the follow-up of the studies. Schmieder et al [*European Heart Journal* 2003; 24:956-62], evaluated the success rate of

radiofrequency ablation of common type atrial flutter in a large series of patients. The study population consisted of 363 consecutive patients with atrial flutter (58±16 years, 265 men) who underwent radiofrequency ablation at the inferior vena cava-tricuspid annulus isthmus. Bi-directional isthmus block was achieved in 328 patients (90%). During a mean follow-up of 496±335 days, 310 patients (90%) remained free from recurrences. Multivariate analysis identified five independent predictors of atrial flutter recurrence: fluoroscopy time ( $p<0.001$ ), atrial fibrillation after atrial flutter ablation ( $p=0.01$ ), lack of bi-directional block ( $p=0.02$ ), reduced left ventricular function ( $p=0.035$ ) and right atrial dimensions ( $p=0.046$ ). The authors concluded that the current anatomical ablation approach for atrial flutter and criteria for evaluation of the inferior vena cava - tricuspid annulus isthmus block are associated with an acute success rate of 90% and a recurrence rate of 10%.

Gilligan et al [Pace 2003;26:53-8], evaluated the long-term outcome of 108 patients after successful radiofrequency ablation until the occurrence of typical atrial flutter, atrial fibrillation, atypical atrial flutter, or death. Patients were followed for a minimum period of three years and a maximum of eight years (17±17 months). Recurrences of typical atrial flutter were usually observed within the first six months (73%), with the remainder occurring between six months and two years (27%), none were observed later. The probability of being free from recurrence of typical atrial flutter was 80% at one year, 73% at two years, and 73% at five years.

Spitzer et al [Europace 2002;4:265-71], investigated the effectiveness of cooled (irrigated-tip) radiofrequency ablation (N=100) compared with conventional radiofrequency application (N=30) for ablation of typical atrial flutter. In 93% of the cooled tip group and in 80% of the control group bi-directional block was confirmed. At six-months of follow-up, recurrence rates were 10% in the cooled-tip group and 26% in the control group. There were no significant complications. Compared with control, cooled tip RF ablation required less radiofrequency pulses and was more effective.

Schreieck et al [JCE 2002;13:980-5], compared the efficacy and safety of cooled-tip and 8-mm-tip catheters for flutter ablation in 100 consecutive randomized patients. Radiofrequency current was applied for 60 to 120 seconds at powers of 40 to 50 W with the closed cooled-tip catheter and in a temperature-controlled mode (65 degrees C/70 W) with the 8-mm-tip catheter. The endpoint was achievement of a bi-directional isthmus conduction block. Complete bi-directional isthmus block was achieved in 99% of patients.

Cross-over was performed in 11 patients after primary use of the cooled-tip catheter and in nine patients after primary ablation with the 8-mm-tip catheter. No significant differences were found in the procedure parameters, such as overall radiofrequency applications (12.4±11.3 vs. 12.9±8.6), ablation duration (42±43 min vs. 39±27 min), and fluoroscopy time (17.0±18.7 min vs. 15.7±10.7 min). In a mean follow-up of 8.3 months, one patient in the cooled-tip group and three patients in the 8-mm-tip group had recurrence of common atrial flutter. They concluded that the closed cooled-tip ablation catheter and the 8-mm-tip catheter have equal and high efficacy for radiofrequency ablation of common atrial flutter.

### **Atypical atrial flutter and atrial fibrillation during outcome**

After successful ablation of typical atrial flutter, its recurrence is relatively uncommon and usually occurs early. However, there is a progressive occurrence of atrial fibrillation and/or atypical flutter during the follow-up, so that some patients require further antiarrhythmic or additional ablative therapy. Gilligan et al [Pace 2003;26:53-8] evaluated the freedom from occurrence of atrial fibrillation or atypical atrial flutter after common atrial flutter ablation. There was a progressive decline over time; 80% at one year, 59% at two years, and 33% at five years. A history of atrial fibrillation or atypical atrial flutter prior to ablation was associated with an increased incidence during follow-up (relative risk 3.4,  $p < 0.05$ ). Freedom from any atrial arrhythmia was only 27% at five years. These authors considered radiofrequency ablation of typical atrial flutter as a palliative procedure for most patients and only one component of the patient's long-term care with atrial tachyarrhythmias. However, Schmieder et al [European Heart Journal 2003;24:956-62], have observed that inferior vena cava-tricuspid annulus isthmus ablation in patients presenting both arrhythmias resulted in a significant reduction in the atrial fibrillation occurrence during follow-up.

### **Pharmacologic vs. RF ablation therapy for atrial flutter - Comparative study**

Natale et al. [J Am Coll Cardiol 2000;35:1898-904], prospectively compared the outcome of patients with at least two episodes of symptomatic atrial flutter in the last four months randomized to regimens of either antiarrhythmic drug therapy or first-line RF ablation.

After institution of therapy, end points included recurrence of atrial flutter, re-hospitalization and quality of life. A total of 61 patients were enrolled in this study, 30 of whom were randomized to drug therapy and 31 to radiofrequency ablation. After a mean follow-up of 21±11 months, 11 of 30 (36%) patients receiving drugs were in sinus rhythm, versus 25 of 31 (80%) patients who underwent radiofrequency ablation ( $p < 0.01$ ). Of

the patients receiving drugs, 63% required one or more re-hospitalizations, whereas post-radiofrequency ablation, only 22% of patients were re-hospitalized ( $p < 0.01$ ). Following radiofrequency ablation, 29% of patients developed atrial fibrillation which was seen in 53% of patients receiving medications ( $p < 0.05$ ). Sense of well being and function in daily life improved significantly after ablation ( $p < 0,01$ ), but did not change in patients treated with drugs. The authors concluded that in patients with recurrent atrial flutter, radiofrequency ablation could be considered a first-line therapy due to its better success rate and quality of life, lower occurrence of atrial fibrillation and re-hospitalization at follow-up.

### Conclusion

There is scientific evidence supporting radiofrequency catheter ablation of common atrial flutter as an appropriate therapy not only in patients with atrial flutter refractory to drug treatment, but also in selected patients who prefer an alternative to antiarrhythmic-drug therapy or repeated electrical cardioversions due to its high success rate and low risk of complications.

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