Typical atrial flutter ablation and the risk of postablation atrial fibrillation

Emanuele Bertaglia, Dipen Shah*

*Department of Cardiology, Civic Hospital, Mirano (VE), Italy, *Division of Cardiology, Hopital Cantonal Universitarie de Geneve, Geneva, Switzerland*

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Typical atrial flutter is readily abolished by creating a line of block along the isthmus between the tricuspid annulus and the inferior vena cava. However, postablation atrial fibrillation occurs frequently, and its occurrence increases during the follow-up.

Preablation atrial fibrillation is the most important risk factor for postablation atrial fibrillation occurrence. Among patients with preablation atrial fibrillation, patients with drug-induced atrial flutter present a lower risk of postablation atrial fibrillation than patients with spontaneous preablation atrial fibrillation.

Patients with preablation lone atrial flutter also present a significant risk of atrial fibrillation development as time passes. Hence, they must be advised of the risk of recurrent symptoms and late atrial fibrillation, and closely followed up despite successful transisthmic ablation.

Patients with atrial fibrillation after transcatheter isthmus ablation should be offered catheter-based pulmonary vein isolation, particularly if atrial fibrillation occurs despite continuation of antiarrhythmic drug therapy.

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Address:

Dr. Emanuele Bertaglia

Dipartimento di Cardiologia Ospedale Civile Via Mariutto, 13 30135 Mirano (VE) E-mail: cardiologia.mirano@ulss13mirano.ven.it

Introduction

Typical atrial flutter (AFL) is readily abolished by creating a line of block along the isthmus between the tricuspid annulus and the inferior vena cava[1-7]. Transcatheter (TC) isthmus ablation is successful in more than 90% of patients. However, in the clinical setting, AFL and atrial fibrillation (AF) often coexist, and the follow-up of patients successfully treated with TC isthmus ablation is complicated by the occurrence of AF[2,5,8-15]. Indeed, although caused by different electrophysiological mechanisms, AFL and AF may share the same arrhythmogenic substrate[12,16,17].

Since the introduction of TC ablation of AFL, several questions were raised by cardiologists: is TC ablation a definite cure for patients with AFL or could their follow-up be characterized by the occurrence of other atrial arrhythmias? Should TC isthmus ablation be suggested for patients with a history of both AFL and AF? Is it possible to recognize patients at higher risk of postablation AF occurrence?

Occurrence of atrial fibrillation after transisthmic ablation

As reported in several papers, AF frequently occurs after transisthmic ablation of AFL: its occurrence ranges from 12 to 54%[8-15,18-23]. Most of these studies investigated few patients, and the duration of the follow-up was often short. In the study with the largest cohort of patients AF was observed in 41.5% of patients after a mean of 20.5 months from ablation of AFL[23]. The different rates of postablation AF could be explained by the different length of the follow-up and by the different tools used to search asymptomatic AF relapses.

The occurrence of AF progressively increased as time passed (Fig. 1): at 4 years, the cumulative probability of AF occurrence increased to 62%. The progression of AF presented a different behavior in patients with and in patients without preablation AF (Fig. 2). While in the former group almost all of the recurrences of AF appeared during the first 2 years (66%), in patients without preablation AF the rate of AF occurrence was quite low during the first 2 years (12%), and increased significantly later (52% at 4 years).

However, not all patients with preablation AF present the same risk of postablation AF. Some authors have already suggested that patients with drug-induced AFL (those with paroxysmal or persistent AF in whom persistent or paroxysmal AFL appeared only after the beginning of treat-

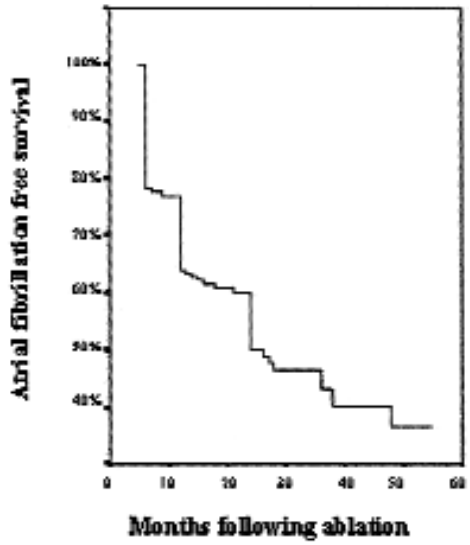

Figure 1. *Kaplan-Meier estimate of the time to atrial fibrillation occurrence in the general population after atrial flutter ablation. Reproduced with permission from Bertaglia et al.[23].*

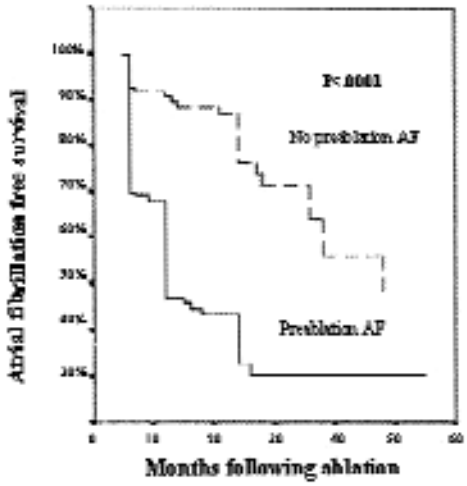

Figure 2. *Kaplan-Meier estimates of the time to atrial fibrillation (AF) occurrence after atrial flutter ablation in patients without preablation AF* (dotted line) *and in patients with preablation AF* (continuous line). *Reproduced with permission from Bertaglia et al.[23].*

ment with IC drugs [IC AFL] or only after the beginning of treatment with amiodarone [amio-AFL]) present an incidence of postablation AF occurrence as low as the incidence of patients with preablation lone AFL[14,20,24]. More recently, we directly compared the long-term outcome of four subgroups of patients after transisthmic ablation: patients with AFL in whom AF had never been documented prior to transisthmic ablation; patients with AFL in whom AF had been documented prior to transisthmic ablation; patients with IC AFL; and patients with amio-AFL[25]. After TC isthmus ablation significantly different outcomes were observed among the four subgroups of patients (Fig. 3).

In patients with amio-AFL the cumulative probability of postablation AF occurrence was significant-

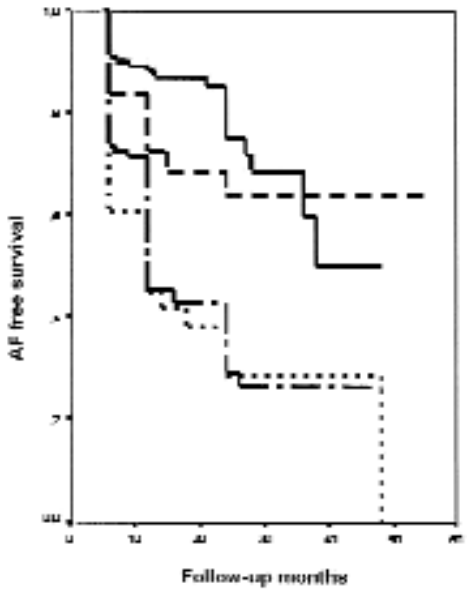

Figure 3. *Kaplan-Meier estimates of the time to atrial fibrillation (AF) occurrence in patients with lone atrial flutter* (continuous line)*, with coexistent preablation AF* (dashed and dotted line)*, with IC atrial flutter* (dotted line)*, and with amiodarone atrial flutter* (dashed line)*. Reproduced with permission from Bertaglia et al.[25].*

ly lower than in patients with coexisting preablation AF, and similar to that seen in the patients with preablation lone AFL. On the other hand, a cumulative probability of postablation AF similar to that recorded among patients with coexisting preablation AF was observed in the patients with IC AFL. Thus, a significant difference between IC antiarrhythmic drugs and amiodarone emerges regarding the efficacy of preventing AF relapses after transisthmic ablation[25]. The protective effect of amiodarone on AF recurrences could be related to the great reduction in intra-atrial conduction velocity exerted by this drug[20]. In this way, amiodarone may prevent the simultaneous occurrence of the reentrant circuits which trigger and perpetuate AF despite the block of the cavo-tricuspid isthmus. Different results were reported by Stabile et al.[26]: they selected for transisthmic ablation only patients with paroxysmal or persistent AF who developed AFL during flecainide infusion. This group reported that over a mean of 54.1 ± 13.1 months 53% of patients remained free of both arrhythmias with continued flecainide treatment[27].

Some interesting differences can also be observed regarding the time of onset of AF recurrences after transisthmic ablation (Fig. 3). Postablation AF began later in patients without preablation AF than in patients with preablation AF. At least in some patients, AFL, rather than triggering AF, seems to be a different right atrial expression of the same electrical disease, which is able, as time passes, to induce left atrial arrhythmias once the preferential route through the flutter circuit is blocked.

Predictors of atrial fibrillation occurrence

Predictors of postablation AF are: preablation AF, left atrial size, left ventricular ejection fraction, inducibility of sustained AF after transisthmic ablation, and age[8,10-12,14-16,21-23,28,29]. Left atrial size is strictly correlated with AF: this arrhythmia is likely to occur in a more diseased, and thus enlarged, atrium[10]. Patients with low left ventricular ejection fraction are more prone to develop AF[8,11,12,15,21]. AF inducibility by programmed electrical stimulation is associated with spatial heterogeneity of atrial refractoriness and with the documentation of AF before and after ablation[29]. A surprising result is the inverse correlation of age with occurrence of postablation AF[23]. According to our knowledge about AF prevalence in the general population[30], it would be expected that postablation AF occurred more frequently in the elderly. On the contrary, it was found that patients < 65 years experienced postablation AF more frequently than patients > 65 years despite similar rates of preablation AF, of predominant preablation AF, and of antiarrhythmic drug use[23]. It is very difficult to explain the reason of this finding.

Preablation history of AF remains the most common predictor of postablation AF occurrence[8,11,12,15,16,22,23,28,29]. Preablation AF identifies patients in whom there is a structural and electrophysiological substrate that allows multi-reentrant circuits favoring AF[11,12,29]. However, among patients with preablation AF different variables predict the occurrence of AF after transisthmic ablation in different subgroups of patients[25]. In patients with preablation AF without drug-induced AFL, postablation AF relapses were significantly correlated with an enlarged left atrium. On the other hand, among patients with IC AFL, the presence of a structural heart disease was significantly correlated with postablation AF recurrences. Treatment with IC antiarrhythmic drugs is not the first choice for patients with structural heart disease. The choice of treating patients with structural heart disease with IC antiarrhythmic drugs generally stems from the failure of other drugs. Patients with structural heart disease on treatment with IC antiarrhythmic drugs are therefore at very high risk of AF occurrence[25].

Mechanistic relationship between atrial fibrillation and atrial flutter

There is a close but poorly understood relationship between AF and AFL[31]. Nabar et al.[14] suggested that at least three different mechanisms could be responsible for this coexistence. More recently, on the basis of the revolutionary findings of Haissaguerre et al.[32], Roithinger and Lesh[17] hypothesized that the persistence of rapidly firing foci might be the underlying mechanism for those patients in whom AF occurred despite TC isthmus ablation. Hsieh et al.[16] proceeded in the same direction, and demonstrated that atrial ectopic beats were able both to induce primary AF and to degenerate typical AFL into AF. The available clinical data indicate that spontaneous AFL is preceded by a burst of pulmonary vein ectopies inducing AF which secondarily organizes into AFL coincident with cessation of pulmonary vein firings. If pulmonary vein discharges trigger AF, they may also trigger AFL, and if all triggers are eliminated AFL might no longer be a problem[33]. Conversely, if TC isthmus ablation alone is performed, the persistence of focal arrhythmogenic triggers might be able, as time passes, to induce AF once the preferential lower, more stable, consistent route through the flutter circuit is blocked[23]. It could be logical and effective to offer these patients pulmonary vein isolation.

Clinical implications

AF occurs frequently after TC isthmus ablation, and its occurrence increases during the follow-up.

Preablation AF is the most important risk factor for postablation AF occurrence. In these patients AF usually relapses early after isthmus ablation. Among patients with preablation AF, patients with drug-induced AFL present a lower risk of postablation AF than patients with spontaneous preablation AF. However, while AF rarely relapses in patients with amio-AFL, in patients with IC AFL, overall those with structural heart disease, the risk of postablation AF is comparable to the risk of patients with spontaneous preablation AF and AFL[25]. For this kind of patients the flecainide infusion test may be useful to select patients for the hybrid therapy with TC isthmus ablation and oral flecainide[27].

However, patients with preablation lone AFL also present a significant risk of AF development as time passes. Hence, they must be advised of the risk of recurrent symptoms and late AF, and closely followed up despite successful transisthmic ablation. ECG Holter monitoring must be advised too, because up to 34% of AF episodes are asymptomatic[23]. Although consensus recommendations do not exist, oral anticoagulation should be continued for at least 3 months even in the absence of any detectable AF. Patients with AF after TC isthmus ablation should be offered catheter based pulmonary vein isolation, particularly if AF occurs despite continuation of antiarrhythmic drug therapy.

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