

Atrial fibrillation ablation: a realistic alternative to pharmacologic therapy

Carlo Pappone* and Vincenzo Santinelli

C Pappone is Director of the Department of Arrhythmology and V Santinelli is Scientific Director of arrhythmology at San Raffaele University-Hospital, Milan, Italy.

The rise in hospital admission rates for atrial fibrillation (AF) among elderly patients worldwide is striking. Rate control can improve quality of life, but does not improve survival or stroke prevention. The continuing high mortality associated with AF and the failure of antiarrhythmic drugs to maintain sinus rhythm have led to a rapid increase in the number of catheter ablation procedures for AF since 1995. Over this relatively short period of time, several new catheter-based strategies have dramatically increased our knowledge of the pathophysiology of this arrhythmia and, most importantly, have demonstrated that AF is a treatable condition. In this viewpoint we discuss the best techniques for AF ablation.

Of the new catheter-based approaches, two have emerged as dominant strategies in current clinical practice: ostial pulmonary vein (PV) isolation and our approach, circumferential PV ablation (CPVA).^{1,2} PV isolation separates the dominant source of triggers that initiate AF,¹ while CPVA eliminates both the triggers and the substrate that initiate and maintain AF.² A recent randomized comparison found that our strategy using CPVA was more effective than segmental PV isolation in patients with paroxysmal AF, which suggests that the superiority of CPVA might depend on the amount of substrate modified.³ Although the efficacy and safety of the two ablation strategies have been established for patients with paroxysmal AF, PV isolation alone is not sufficient to treat permanent AF.¹ Furthermore, the extremely encouraging results of CPVA, even in patients with permanent AF—who represent the majority of AF patients—suggest that our approach should be preferred in all patients undergoing AF ablation. Since demonstrating 5 years ago that CPVA is safe and does not require long procedural times, some electrophysiologic groups, including Sanders *et al.*, the pioneering group from Bordeaux, have substantially changed their initial ablation strategy from focal or PV isolation to more-extensive lesions and modification of the atrial substrate.⁴ The Bordeaux group has shown

that deployment of linear lesions is performed in at least 50% of patients with paroxysmal AF undergoing PV isolation, and the overall success rate without antiarrhythmic medication at 6 months is reported to be 91%. Therefore, it has become evident that more-extensive lesions, such as those initially performed by our group,² remain the key to successful AF ablation;^{4,5} they isolate PV ectopy, which could initiate AF, reduce the potential of re-entry circuits, which can act as mother rotors, and modulate the local autonomic nervous system by destroying vagal nerve endings endocardially. Conversely, surgical compartmentalization of the atria was highly effective in restoring and maintaining sinus rhythm in patients with permanent AF; however, early attempts to replicate the surgical approach with ablation catheters by creating long, linear lesions in the left atrium were associated with high complication rates. Although they are safer, linear lesions limited to the right atrium showed low efficacy in preventing recurrences in permanent AF and have therefore been abandoned. The delivery of long, linear lesions in the left atrium and ensuring completeness of ablation lines can be effective but technically challenging, requiring a mean procedure time of 8 h.⁶ Our approach, which has been performed on more than 7,000 patients (59% with permanent AF, 45% with structural heart disease and 44% with enlarged atria) and does not necessarily require complete ablation lines, is a feasible and simple technique with acceptable risks. In general, complications were not serious and only one case of nonfatal atrioesophageal fistula occurred. Notably, postablation atrial tachycardia develops in less than 4% of patients. Most importantly, in patients with permanent AF the technique is associated with maintenance of sinus rhythm similar to that achieved with the surgical maze.

In 2002, we started to perform circumferential lines at least 15 mm from the PV ostia⁷ when possible—rather than at least 5 mm as initially proposed—to include much more substrate, as smaller ablated areas predict AF recurrence.² Two

Correspondence

*Department of Arrhythmology University Hospital San Raffaele Via Olgettina 60 20132 Milan Italy carlo.pappone@hsr.it

Received 9 June 2005

Accepted 31 August 2005

www.nature.com/clinicalpractice
doi:10.1038/ncpcardio0373

additional posterior lines and a mitral isthmus line are currently performed for a mean duration of 55 min to prevent iatrogenic left-atrial tachycardia.⁷ PV isolation with more-extensive lesions to cure permanent AF could require much longer procedure times than CPVA. In addition, many patients undergoing PV isolation will need more than one procedure, with or without antiarrhythmic drugs, to achieve a 75% reduction in symptomatic episodes. In our opinion, CPVA is more effective, and is the simplest ablation strategy for treating patients with both paroxysmal and permanent AF, as it can simultaneously eliminate most or all of the mechanisms that initiate and perpetuate AF.

We first demonstrated in 2004 that CPVA can also attenuate the parasympathetic tone, which enhances the long-term benefit of the procedure for curing AF with success rates approaching 100%.⁸ It is well known that parasympathetic stimulation is involved in the induction and maintenance of AF, as vagal stimulation dramatically shortens the atrial refractory period, increasing the probability that multiple re-entrant circuits can exist simultaneously in the atrial myocardium, which further increases the stability of AF. Interestingly, Nakagawa *et al.* recently confirmed our observations by identifying four major autonomic ganglionated plexuses outside the PV ostia in patients with AF.⁹ These findings, taken together, create the opportunity for new AF ablation strategies that potentially offer a specific lesion set, which can be easily obtained by our approach. Notably, our seminal observations of vagal denervation to cure AF demonstrate that PV foci as initiating factors for AF—as first described by the Bordeaux group¹—are only the tip of the iceberg. Overall, the considerable volume of data collected on patients undergoing AF catheter ablation suggests that ablation should not be considered an experimental therapy but should be a first-line therapy for AF. Furthermore, our extremely encouraging results are based on an accurate and intensive electrocardiographic monitoring to assess asymptomatic AF recurrences (i.e. we used 48 h Holter monitoring before ablation, repeated 1 week and 1, 3, 6 and 12 months after ablation, and more than 4 daily transtelephonic electrocardiographic recordings for at least 1 year after ablation).^{7,8} Maintenance of sinus rhythm without the use of antiarrhythmic drugs is more desirable than AF. A controlled, although not randomized, study from our group has shown clinical improvement

and a return to baseline community mortality rates after CPVA compared with drug therapy. These results suggest that AF ablation could be considered as first-line therapy, as reported in the randomized study by Wazni *et al.*¹⁰

In current clinical practice, AF ablation is reserved for highly symptomatic patients who have not benefited from multiple antiarrhythmic drug therapy. On the basis of our extensive experience, we believe that AF ablation is a safe, feasible and realistic option for treating AF in a wide population of patients. We also believe that the excellent results reported by pioneering groups can be replicated by other centers, particularly with the use of remote magnetic-navigation systems. With these findings, hopefully indications for ablation of AF will include the growing AF population, thereby obviating the need for antiarrhythmic drug and anticoagulation use. In our opinion, to improve outcome, ablation might need to be carried out when arrhythmia is still paroxysmal, rather than later when optimum drug treatment has failed to control symptoms adequately.

References

- 1 Haissaguerre M *et al.* (1998) Spontaneous initiation of atrial fibrillation by ectopic beats originating in the pulmonary veins. *N Engl J Med* **339**: 659–666
- 2 Pappone C *et al.* (2001) Atrial electroanatomic remodeling after circumferential radiofrequency pulmonary vein ablation: efficacy of an anatomic approach in a large cohort of patients with atrial fibrillation. *Circulation* **104**: 2539–2544
- 3 Oral H *et al.* (2003) Catheter ablation for paroxysmal atrial fibrillation: segmental pulmonary vein ostial ablation versus left atrial ablation. *Circulation* **108**: 2355–2360
- 4 Sanders P *et al.* (2005) Spectral analysis identifies sites of high-frequency activity maintaining atrial fibrillation in humans. *Circulation* **112**: 789–797
- 5 Nademanee K *et al.* (2004) A new approach for catheter ablation of atrial fibrillation: mapping of the electrophysiological substrate. *J Am Coll Cardiol* **43**: 2044–2053
- 6 Ernst S *et al.* (2003) Catheter-induced linear lesions in the left atrium in patients with atrial fibrillation: an electroanatomic study. *J Am Coll Cardiol* **42**: 1271–1282
- 7 Pappone C *et al.* (2004) Prevention of iatrogenic atrial tachycardia after ablation of atrial fibrillation. A prospective randomized study comparing circumferential pulmonary vein ablation with a modified approach. *Circulation* **110**: 3036–3042
- 8 Pappone C *et al.* (2004) Pulmonary vein denervation enhances long-term benefit after circumferential ablation for paroxysmal atrial fibrillation. *Circulation* **109**: 327–334
- 9 Nakagawa H *et al.* (2005) Localization of left atrial autonomic ganglionated plexuses using endocardial and epicardial high frequency stimulation in patients with atrial fibrillation. *Heart Rhythm* **2**: S10–S11
- 10 Wazni OM *et al.* (2005) Radiofrequency ablation vs antiarrhythmic drugs as first-line treatment of symptomatic atrial fibrillation: a randomized trial. *JAMA* **293**: 2634–2640

Competing interests

The authors declared they have no competing interests.