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Review

Current strategies for non-pharmacological therapy of long-standing persistent atrial fibrillation

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ABSTRACT

Non-pharmacological rhythm control of atrial fibrillation (AF) is becoming increasingly important in our aging society. Advancement of catheter ablation techniques in the last decade has provided a cure for AF patients, with a nearly established efficiency for paroxysmal cases. However, since ablation of persistent/chronic AF cases is still challenging, early treatment of paroxysmal AF before transformation to the persistent/chronic form is mandatory. Although there is a consensus that pulmonary vein isolation is the first-line approach for ablation of long-standing persistent AF, similar to that for paroxysmal AF, there are still wide variations in the adjunctive approach to modify the atrial substrate of persistent AF (anatomical linear ablation, electrogram-based complex fractionated atrial electrogram ablation, ganglionated plexus ablation, etc.). Since data comparing the effectiveness of these adjunctive approaches are still lacking, large-scale controlled trials evaluating the effect of catheter ablation in diverse patient populations on a long-term basis are needed to establish the appropriate approach for long-standing persistent AF. Furthermore, the development of de novo ablation methods (new energies, new targets, etc.) is expected to improve ablation outcome in patients with long-standing persistent AF.

Contents

1. Introduction

Since the landmark paper published by Haissaguerre et al. demonstrating the pulmonary veins (PVs) as the dominant triggers of paroxysmal atrial fibrillation (AF), the efficacy of radiofrequency catheter ablation for atrial fibrillation has been established. After the initial attempt to ablate the firing foci of the PVs, PV isolation (PVI) has become the main target in cases of paroxysmal AF. In contrast, the role of the atrial substrates that maintain atrial fibrillation increases during AF progression from paroxysmal to the long-persistent form, which requires adjunctive treatment in addition to PVI. Years have passed since the numerous novel catheter-based approaches for long-persistent AF have been addressed; therefore, the debate still remains concerning the indications for catheter ablation, the approaches appropriate in each case, and the endpoints of ablative therapy. In this review, we focus on the current approaches for catheter ablation of long-lasting persistent AF cases.

This review summarizes the current ablative techniques and emphasizes the appropriate applications and limitations of catheter ablation for long-lasting persistent AF.

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2. Baseline ablation strategies targeting PVs

It is well known that PVI was first developed to eliminate the triggers that initiate attacks of paroxysmal atrial fibrillation [1]. Subsequently, the additional function of the PV myocardium to perpetuate atrial fibrillation has been a focus [2]. Now, most approaches for eliminating long-persistent atrial fibrillation include PVI as the baseline procedure to reduce both the trigger and the maintaining factor of persistent AF. Although variations still exist in the procedures that target the PVs, including circumferential PV ablation (CPVA), [3] extensive encircling PV isolation (EEPVI), [4] PV antrum isolation (PVAI), [5] and BOX isolation [6] (Fig. 1), there is a common consensus among them [7]. To reduce the risk of PV stenosis and eliminate the firing foci around the PV ostium, ablations should be performed in the atrial tissue located in the antrum rather than the PV ostium. If the PVs are targeted, complete electrical isolation should be the goal. Radiofrequency (RF) energy can be applied either segmentally, guided by a circular mapping catheter, or by a continuous circumferential ablation lesion created to surround the ipsilateral right or left PVs.

Analysis of 4 major articles in which antral encirclement of PVs in cases with long-standing persistent AF underwent a single-procedure, showed a drug-free success rate ranging from 37% to 56% at approximately 1 year (Fig. 2) [8]. Integration of repeat procedures (mean, 1.3 per patient) increased the drug-free success rate to 59%. The combination of drugs and multiple procedures yielded a success rate of approximately 77%.

3. Adjunctive ablation strategies (electrogram-guided ablation and linear ablation)

Although ablation strategies targeting the PVs are the cornerstone of AF ablation procedures for both paroxysmal and persistent AF, continued efforts are underway to establish additive strategies to improve ablation outcome. Currently, one of the most popular methods for AF-substrate modification in the atrium is to apply RF energy and create lesions targeting the areas with complex

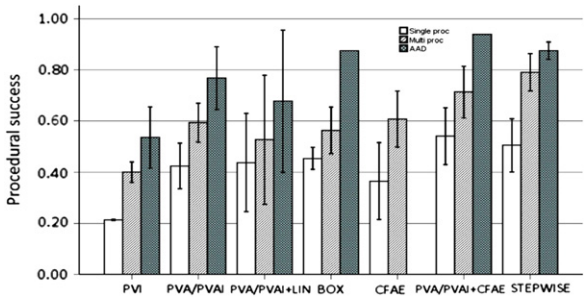

Fig. 2. Clinical success of various ablation techniques for persistent/long-standing persistent AF. The rates shown are for single-procedure, drug-free success (white), multiple-procedure success (diagonal crosshatch), and antiarrhythmic drug (AAD)-assisted success (dark double hatch). LIN=conventional linear ablation; PVA=pulmonary vein antrum ablation; PVAI=PV antrum isolation. Reproduced from Ref. [8].

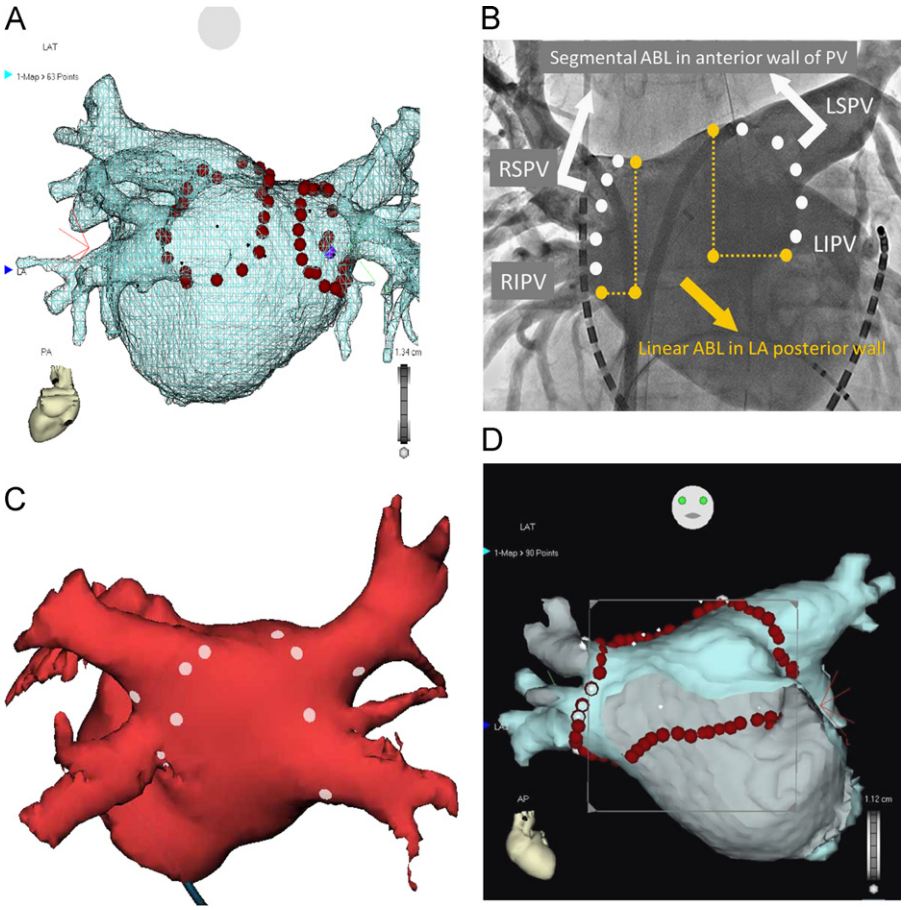

Fig. 1. Variations in the pulmonary vein isolation methods. (A) CPVA/CPVI (Circumferential PV ablation/isolation), (B) EEPVI (Extensive encircling PV isolation), (C) PVAI (PV antrum isolation), and (D) BOX isolation.