Focal-, Circular-, or Balloon-Based Atrial Fibrillation Ablation
How to Interpret the Data in a Rapidly Developing Field?*

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Catheter ablation of atrial fibrillation (AF) has been shown to be more effective than antiarrhythmic drug therapy in maintaining sinus rhythm (1,2). Therefore current guidelines recommend AF catheter ablation as a class I therapy in symptomatic patients, refractory to antiarrhythmic drugs, and even consider it as first-line treatment of paroxysmal AF in the absence of structural heart disease (3–6). Based on the seminal findings of Haissaguerre et al. (7), identified the pulmonary veins as a common site for focal triggers initiating AF, pulmonary vein isolation (PVI) currently presents the cornerstone of most AF ablation procedures (8).

However, PVI using a focal irrigated radiofrequency (IRF) catheter is a very complex procedure with a long learning curve. Balloon- or multielectrode-based single-shot devices have been developed aiming at simplifying AF ablation and shortening procedure time. Of these alternative technologies cryoballoon ablation (CBA) is the most frequently used and investigated method. A circumferential multielectrode ablation catheter system presents an alternative single-shot device facilitating mapping and ablation of the pulmonary veins (e.g., with duty-cycled phased radiofrequency ablation [PRF]). Initial thriving results were attenuated by the description of a higher incidence of silent cerebral microemboli (9–11).

In this rapidly expanding field of new technologies with lack of randomized studies, meta-analysis like the present one under evaluation (12) are very welcome to further judge on the comparative effectiveness and safety of different energy sources and tools. In this issue of JACC: Clinical Electrophysiology, Kabunga et al. (12) performed a network meta-analysis for the first time comparing point-by-point IRF versus CBA versus duty-cycled PRF energy. A network meta-analysis facilitates assessment of relative effectiveness of treatments that have not been compared directly in a randomized trial (e.g., CBA and PRF) but have each been compared to other treatments (IRF) (13). In this way, 31 studies performed between 2009 and 2014 were included. Meta-analysis revealed that PRF was associated with higher freedom from AF and shorter procedure duration compared to CBA and IRF. However, considering only randomized controlled trials (3 comparing PRF vs. IRF and CBA vs. IRF, respectively, and 1 comparing CBA and PRF) success rates were similar between IRF and PRF (p = 0.35) with shorter procedure time of the latter (p = 0.006) and higher with IRF compared to CBA (p = 0.04) with similar procedure times (p = 0.47). No differences were detected between CBA and PRF in terms of efficacy and duration.

Interesting, but do these data provide final conclusions on the three methods under investigation? Certainly not! This is due to a number of significant limitations that need to be recognized and considered: First, in actuality, most studies included were observational or retrospective in design with only few randomized controlled studies. Considering only randomized trials with a total of 702 patients no differences in success rates could be observed between PRF and IRF ablation with only one randomized study on PRF versus CBA, also with similar outcome.
Second, ablation strategies differed between the groups with several IRF studies performing ablation lines in addition to PVI probably explaining longer procedure durations and worse outcome. Third, studies under evaluation included mixed populations of paroxysmal and persistent AF patients. Fourth, definition of adherence to follow-up and details on follow-up (duration and frequency of Holter monitoring, details on antiarrhythmic drug use) were ill defined in most of the studies. Fifth, safety and complications could not be statistically analyzed due to inconsistency in reporting of morbidity outcomes and low event rates. And last, the main limitation of this analysis can be attributed to the fact that technologies compared already underwent significant enhancements. This is especially true for CBA with respect to the introduction of the second-generation cryoballoon with greater efficacy and shorter ablation times (14).

In the current analysis only studies using the first-generation balloon were included. Also, IRF ablation was performed without contact force sensing catheters that go along with better outcomes (15,16). With respect to PRF, the catheter used in these studies, was redesigned because of safety concerns. Instead a novel catheter design has been introduced with better thermal conductivity and improved tissue contact aiming at a reduction of embolic risk (17).

These facts highlight the difficulty to compare technologies when they are advancing so rapidly, hampering final decision making on the technologies under evaluation. For all those reasons, the results of this well-done meta-analysis will have only moderate impact on our daily practice.

Currently, ablation tools for PVI are usually chosen based on operator preference, patient preference, or economical aspects, but not on scientific data from randomized controlled trials. We therefore strongly believe that there is an urgent need for more investigator-initiated randomized head-to-head trials comparing novel ablation tools for PVI at an early stage to ultimately answer these questions.

**REFERENCES**


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