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AF ablation: Single shot multielectrode or multishot single electrode?



There is no doubt that catheter ablation is established as an important tool in the armoury used in the management of symptomatic, drug-resistant atrial fibrillation [1]. Effective pulmonary vein isolation continues to be the main foundation of this approach [2]. Complete isolation of the pulmonary veins is associated with fewer atrial fibrillation recurrences when compared with incomplete lesions [3]. With the wider application of this treatment modality in the last decade, a race has begun among the emerging technologies for the most effective, efficient approach with the least adverse effects and cost. The conventional single tip catheter point-by-point radiofrequency ablation (RFA) approach is now being challenged by other technologies such as balloon cryo-ablation. This was shown to be non-inferior in the recent FIRE AND ICE study [4]. The need for improved strategies not only stems from a need to increase the efficacy of current tools (which are not yet optimal even with complete acute isolation [3]), but also from procedure complexity, time cost and radiation exposure perspectives. A longer learning curve and greater catheter skills are required for the conventional single catheter technique with better results reported in high volume centres [5–7]. Among newer technologies aiming to reduce the complexity and the duration of the procedure is pulmonary vein isolation using Multi-Electrode Radio-Frequency Ablation (RFA). Being a single-shot catheter technique, it might be a possible solution to those downsides of conventional RFA. The two most widely used single shot multi-electrode RFA catheters are the platinum-tipped electrode pulmonary vein ablation catheter (PVAC, Medtronic Inc., USA) – replaced recently by PVAC GOLD with 9 gold electrodes – and nMARQ (Biosense Webster, Diamond Bar, USA). The irrigated decapolar nMARQ catheter was recalled two years ago after two fatalities were reported due to atri-oesophageal fistulae [8].

With only few relatively small studies available examining this modality, the systematic review by Dursun Aras et al. is a timely attempt to shed some light on the evidence currently available. It addresses the question of effectiveness of the multi-electrode versus conventional point by point RFA and its impact on procedural time and radiation exposure.

The meta-analysis included 13 studies, both randomized and non-randomized, and looked at their procedural characteristics including procedure and fluoroscopy times, clinical outcomes including AF recurrences, and adverse events. There were a total of 2152 patients (1026 patients in the multi-electrode RFA group vs. 1126 in the conventional RFA group). The majority of patients had paroxysmal AF; however, 6 of the included studies had a

proportion of patients with persistent AF (18.5–45%). Only studies reporting follow up outcomes at 6 months or more were included. The PVAC[®] Multi-electrode catheter was used in 11 studies while the nMARQ[®] catheter was used in 2 studies (65 patients only). Pulmonary vein isolation was the aim in all patients, but in approximately 485 patients, additional ablation (linear, CAFE or both) was performed in either group.

The study found a 34 minute reduction in total procedure time (95% CI 50.1 to 18.5 minutes, $p < 0.001$) and a 7.1 minute reduction in fluoroscopy time (95% CI 12.0 to 2.2 minutes, $p < 0.01$) in the multi-electrode RFA group when compared with the conventional RFA group. There was no significant difference between AF recurrence seen between the two groups, although a trend toward superior outcome was observed in multi-electrode group (RR = 0.90 95% CI 0.80–1.01, $p = 0.066$). There was no significant difference in complication rates.

Different methods of assessing recurrence of arrhythmias were used including a simple 12 lead ECG (9.4%), Holter monitoring with duration varying from 24h to 1 week (68.7%), 7 day ECG external loop recorder (19.5%) and implantable cardiac monitoring (2.3%). The definition of the blanking period was not also uniform with blanking periods ranging between 1 and 3 months.

In the small studies using the nMARQ[®] catheter, there was relatively longer procedural and fluoroscopy time when compared to the other studies. However, with the small number of patients in this group (65 patients) in two studies, the learning effect from the use of this novel catheter may have impacted on those durations. Such effect on procedural parameters was described in the literature with the early use of circular multi-electrode catheters [9].

Cerebral embolization was raised in as a concern in the early days of this technology with a stroke risk of 2.3% in the TTOP-AF study. However, the adequacy of the anticoagulation in those patients was questioned and was thought to have contributed to the observed high rate of cerebrovascular events. In earlier studies, higher rates of silent cerebral ischemia were also seen on diffusion-weighted sequence MRI with this technology when compared to conventional RFA and cryo-ablation but with new procedural modification, and the improved hardware and software of the energy delivery systems, lower rates have been reported recently [10]. Similar to the reported rate of thromboembolism in a previous meta-analysis by Andrade et al. [11] (0.63%), this study showed cerebrovascular accidents rates in the multi-electrode RFA group being 0.6%. This was not statistically significant when compared with the conventional group (0.2%, $p = 0.121$).

The other relevant issue identified by this study is the difficulty

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faced comparing studies because of variability in definitions of outcomes and endpoints, and the ways of assessing them. Different procedural length parameters are reported (including skin-to-skin time and left atrial dwell time). Success and complication outcomes including AF recurrence definition and the timing/methods of detection are not uniform. This urges more standardisation of definitions and reporting amongst studies to enable comparisons between the new evolving technologies and draw stronger conclusions from such meta-analyses.

While the study is limited by the heterogeneous nature of the smaller trials of which most are non-randomized, it sets the ground for the need of a larger randomized trial to explore the potential of such technology in comparison to the other more widely used available modalities. It shows at least similar rates of AF recurrence between multi-electrode RFA and conventional point-by-point RFA with less time cost and radiation exposure. Encompassing the advantages of less radiation and less complexity than conventional RFA, it has a promising future if equal efficacy is proven. For this technology to thrive and establish itself in current practice, a large randomized trial of the scale of the FIRE and ICE study is necessary to provide more definitive answers about the efficacy and safety outcomes of this technique compared with conventional RFA.

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