EDITORIAL

Balloon cryoablation for paroxysmal atrial fibrillation

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This editorial refers to ‘One year follow-up after cryo-balloon isolation of the pulmonary veins in patients with paroxysmal atrial fibrillation’ by Y. Van Belle et al., on page 1271

Catheter ablation has traditionally been performed for atrial fibrillation using a point-by-point ablation approach using radiofrequency energy. There are several inherent limitations of this approach. The efficacy of point-by-point radiofrequency ablation is limited by the rapid formation of oedema, which may potentially reduce lesion penetration, the relatively high incidence of conduction recovery and the inherent inaccuracies of trying to create curvilinear lesions using a technique that was originally developed and used for discrete point ablation. There are also inherent risks using radiofrequency energy in the relatively thin-walled left atrium including the risk of cardiac tamponade due to steam pop phenomenon as well as the risk of injury to adjacent structures including the pulmonary veins (stenosis), oesophagus, nerve plexi, aorta, bronchi, pericardium, phrenic nerve, and lungs.1 Added to these problems is the observation that the procedure is extremely demanding in terms of operator competency and dexterity with a somewhat steep learning curve with better results seen in experienced higher volume centres.1

Given these limitations, it is not surprising that alternative energy sources and delivery platforms are under investigation to more specifically target pulmonary vein muscular sleeves. At present, cryoenergy is the only alternative energy source available in the clinical setting and is probably much less likely to cause pulmonary vein stenosis or oesophageal damage, although this has not yet been proved in a direct clinical comparison.2 Studies of cryoablation of slow and accessory pathways have demonstrated a higher recurrence rate3,4 and, by extension, a higher pulmonary vein recovery rate may be expected with cryoablation, reflecting the notion that this is a ‘gentler’ energy source. Cryoablation of pulmonary veins was initially described using a point-by-point ablation strategy.3 Owing to limited success and long procedure durations (due to the fact that 4 min is required to form each lesion) alternative platforms were developed including a hollow, curvilinear catheter (Arctic Circler, Cryocath Inc, Montreal, Canada) and then a balloon-based platform (Arctic Front, Cryocath Inc, Montreal, Canada). A theoretical advantage of balloon-based technologies is that they may offer a simpler, faster, and more widely applicable means of achieving pulmonary vein isolation. A drawback of several balloon-based technologies is the highly variable anatomy of pulmonary veins with the notion that ‘one size does not fit all veins’6 and the higher rate of phrenic nerve palsy, presumably due to the physical effect of over sizing the balloon in the right superior pulmonary vein and causing impingement of the phrenic nerve. The concept of a simple balloon-based strategy is probably only really applicable to a small percentage of AF cases—those with paroxysmal AF with minimal evidence of atrial re-modelling and suitable pulmonary vein anatomy. It seems clear that more complex cases such as persistent AF and long-standing persistent AF require much more extensive atrial ablation including additional linear ablation and electrogram-based ablation7,8 and there is little data at present about the efficacy and practicality of achieving this with cryoablation platforms.

The study by Van Belle et al.9 reported in this issue of Europace provides important long-term follow-up data on a consecutive cohort of 138 patients with paroxysmal AF and minimal atrial dilation. The study demonstrates some of the high benchmarks that have been set by the recently published consensus statement,10 and the authors are to be congratulated on the rigorous nature of the study design and reporting. The criticism remains that this is a single-centre experience, unfortunately, however, large multicentre data sets are still rarely reported for any of the AF ablation techniques. While the single-procedure success seems low (49%), it is similar to some radiofrequency ablation series and the clinical success rates after repeat...
procedures are markedly higher. Complete freedom from atrial fibrillation certainly matters for scientific reporting of data and in certain patients (e.g., those with a previous history of stroke), however, suppression of symptoms and improved quality of life are the main reasons why patients choose to undergo this procedure. The reduction in AF burden and improvement in quality of life is therefore an important endpoint.

In this study, early recurrence of atrial fibrillation significantly predicted later recurrence with need for re-do procedures or on-going antiarrhythmic medications, and is similar to recently published data concerning radiofrequency ablation. The validity and duration of blanking periods remain questionable and are not supported by solid scientific data.

The mean procedure duration of 207 min, and mean fluoroscopy duration of 57 min, from an experienced group who were very early adopters of this new platform, and used it exclusively, suggests that this is not a simple procedure. Indeed ‘touch up’ ablation using a point-by-point ablation catheter was required in 40% of patients, so the technique does not really reduce the important requirements of manual dexterity and understanding of pulmonary vein electrograms. The complications were also important with a rate of serious complications of 8.6% of patients, including phrenic nerve palsy in four patients (despite careful risk management during the procedure) and pulmonary vein rupture in one patient. Groin complications were also seen in four patients (two requiring transfusion) and this reflects the fact that the platform requires a large groin sheath in patients who are subsequently aggressively anticoagulated. Pulmonary vein stenosis was not seen at 3 month CT scanning, and clinical evidence of pulmonary vein stenosis was not seen during the longer follow-up, which included a targeted history by an electrophysiologist. Atrioesophageal fistula and thrombo-embolism were also not seen in this study.

The search for the ‘ideal’ energy source-delivery platform combination continues and in the future magnetic navigation and robotic assistance may play an important role in this respect. Until better alternatives reach the clinical laboratory, balloon-based cryoablation offers a modestly effective alternative to radiofrequency ablation for patients with paroxysmal atrial fibrillation in whom pulmonary vein isolation alone is planned. Operator familiarity and experience in using a particular technology and delivery platform is probably a critical factor in determining outcomes, and this can only be controlled in large, well-designed multicentre randomized trials.

References