Case Volume and Procedural Outcomes in Ablation for Atrial Fibrillation: Practice Makes Perfect?

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Ablation for atrial fibrillation (AF) is an established therapy that continues to grow in scope and indication(1). The benefits of AF ablation are well recognized in heart failure and symptomatic paroxysmal AF. Additionally, the recent EAST-AFNET4 trial demonstrated benefit for an early AF rhythm control strategy even in asymptomatic patients (2). This change in paradigm from rate and rhythm control equivalence may be partially related to the increasing use of AF ablation for rhythm control. As ablation therapy continues to proliferate, questions of how to optimise procedural outcomes at a health service level arise. A key component of this optimisation is defining predictors of outcomes related to ablation procedures.

One such predictor is procedural case volume. Studies outside of AF ablation have demonstrated complex relationships between institutional size, procedural volume, case difficulty and outcomes. Published data on transcatheter aortic valve replacement (TAVR) for example, suggest a durable link between hospital case volume and mortality even after adjusting for institutional learning curves and known risk factors for poor outcomes (3). These insights have relevance for AF ablation for which there is wide-ranging procedural variation across factors such as lesion sets and type of ablation energy. The relationship between AF ablation volume and outcomes have been explored in previous studies(4, 5). Tonchev and colleagues, in a meta-analysis, demonstrated a significantly lower risk of complications in centres performing >100 procedures per year (OR 0.62, 95%CI 0.53 to 0.73) (4). This carried over to mortality, which was significantly lower in high

volume centres (OR 0.33, 95% CI 0.26-0.43). Ablation efficacy was also greater in higher volume centres. Importantly, the majority of procedures included in this meta-analysis of real-world data were undertaken in low volume centres (70.9% in centres with <100 procedures/year) alerting to the reality that high-volume centers are not readily available to most patients.

The influence of energy types (cryoballoon ablation versus catheter based radiofrequency ablation) on the relationship between procedural volume and outcomes is less well defined. This is of relevance as cryoablation appears to have a gentler learning curve than radiofrequency ablation for centres that are newly introducing AF ablation(6). In this issue of the *journal* , Kanaoka and colleagues present data on the relationship between procedural volume, energy type and acute procedural outcomes based on analysis of the Japanese National Database of Insurance Claims and Specific Health Check-ups. The authors identified 270,116 patients from this database undergoing first-time AF ablation with cryoablation or radiofrequency energy. A small subset of patients who underwent hot balloon and laser ablation were excluded as the numbers were too low. Complications were identified using administrative coding for the most common diagnoses associated with ablation risks. Ablation success could only be defined using coding for repeat AF ablation or initiation of anti-arrhythmic drug within 1 year.

The authors split hospitals into quartiles using case volume resulting in groups with medians of 69 (very low), 157 (low), 252 (high) and 469 (very high) procedures per year. They found that the relative risk of peri-procedural complications was approximately 10-20% lower in all other groups when compared with the very low procedural volume hospitals. Cubic spline plots demonstrated a plateau effect, with no further reduction in complications when hospitals approach 150-200 cases per year. Similarly, when considering AF recurrence assessed by repeat ablation or initiation of anti-arrhythmic drugs up to 1 year, there was approximately a 10% relative risk reduction in the low, high and very high-volume hospitals when compared to very low-volume centres. Of note, there appeared to be a similar plateau volume of approximately 150-200 cases per year above which the benefit attenuated. The relationship between procedural volume and outcomes was however, only seen with RF ablation. Among the more than 56,000 cryoablation cases, there were no significant differences in complications or recurrence in the low, high or very high procedural volume hospitals when compared with the very low volume hospitals. Of note, there was a similar burden of AF related comorbidities in the radiofrequency and cryoablation populations.

These results of Kanoaka and colleagues add further evidence to the notion that, when it comes to AF ablation, there appears to be a threshold of hospital procedural volume above which the risk of complications and recurrence decreases. The finding of a threshold in the range of 150-200 procedures per year, is in keeping with previous work suggesting benefits in excess of 100 procedures per year(5). Additionally, the present study sheds new light on the effect of ablation type on this relationship. In keeping with the recognition that cryoablation appears to offer an easier learning curve, the effect of procedural volume on both safety and efficacy outcomes was eliminated when considering only cryoablation cases.

Limitations of the study have to be recognized. The study is observational, retrospective and derived from a national database. These factors admit the potential for unmeasured confounders and imperfect assessment of outcomes. The definition of ablation success was based on coding for repeat ablation or use of antiarrhythmic drugs within the first year. This definition, although pragmatic, does not account for recurrence occurring outside of 1 year or recurrence that did not result in repeat ablation or anti-arrhythmic drug therapy. Furthermore, complications were defined using administrative coding. Notably, this coding was not able to identify phrenic nerve injury, which occurs in approximately 5-6% of patients undergoing cryoablation(7). In addition, significant differences existed between the RF and cryoablation groups. There was a greater proportion of paroxysmal AF in the cryoablation compared to RF group (74% versus 46%). Because RF ablation allows for more flexibility in ablation lesion set, this energy form tends to be used in those with more advanced atrial remodelling. Hence, it is very likely that the RF group comprised a more complex patient group with a greater dependence on operator experience and case volume. The observed differences in learning curve between the two energy sources may have been less striking or even absent, had the groups been matched. The study however, has the advantage of the use of a database that covers of 98%

of the Japanese population and magnitude of case volume included, allow for valuable insights.

Abundant work has now demonstrated that hospital procedural volume is a key component of optimising outcomes from any complex interventional procedure(3, 5). The improved outcomes observed as a result of hospital procedural volume are likely due to a wide-range of additional factors that include appropriate patient selection, an experienced electrophysiology laboratory team and standardized, guideline-directed pre- and post-procedural management(8). The Heart Rhythm Society's 2020 AF Centres of Excellence whitepaper outlines the rationale and guidance for key components of an AF Centre of Excellence(8). However, as the increasing benefit of AF ablation creates an increasing demand for the procedure, a balance must be struck between having very few centres of excellence and abundant centres with limited experience. In this context, the results of the current study by Kanoaka and colleagues are valuable and raises the possibility of a two-tiered approach. That of lower volume centres providing less complex procedures such as cryoablation for simpler cases of AF and higher volume 'Centres of Excellence' providing advanced ablation procedures for more complex AF cases. Such a division of labor may strike the balance between ablation availability and optimal outcomes. This differentiation, based on the characteristics of procedure offered and type of patients treated, will likely achieve greater importance as future technologies such as pulsed field ablation emerge and promise faster, safer and easier ablation strategies for AF(9).

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