Editorial

Appropriateness of concomitant surgical ablation for atrial fibrillation during redo cardiac surgery

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Concomitant surgical ablation (SA) results in increased freedom from atrial fibrillation (AF) of patients undergoing cardiac surgery without additional operative risk of mortality or major morbidity, and is recommended at the time of concomitant cardiac procedure (1-6). Recent evidence reemphasized that concomitant SA conferred significant improvements to longitudinal risks of ischemic stroke, readmission rate, and long-term survival without increasing the rate of perioperative complications (7). The Cox-Maze IV is currently the gold standard surgical treatment for AF with estimated freedom from AF at 1 year postoperatively of 93% although it can increase the risk of pacemaker implantation after concomitant mitral valve surgery (8-10). Biatrial lesion patterns are more effective in persistent and long-standing persistent AF (11,12). Furthermore, a recent systematic review with meta-analysis showed that concomitant Cox-Maze in AF patients undergoing mitral valve surgery was associated with better mid-term freedom from AF when compared to pulmonary vein isolation (PVI) (13). In addition, a survival benefit was observed among patients after concomitant Cox-Maze procedure, although data from randomized controlled studies are still lacking (13).

Since recently, in patients with AF presenting for cardiac surgery, level A evidence supports concomitant left atrial appendage obliteration (LAAO) (14). Interestingly, SA of AF in patients undergoing cardiac surgery is associated with improved 3-year survival even when compared with LAAO alone [hazard ratio (HR): 0.90; P<0.001] (15). Furthermore, analysis of SA from the Society of Thoracic Surgeons Adult Cardiac Surgery Database propensity matched 28,739 patients who received SA to 28,739 who did not, and found a 30-day relative risk reduction in favour of SA for mortality (relative risk, 0.92) and stroke (relative risk, 0.84) (2). Based on recent findings, existing clinical practice guidelines provided a class 1 recommendation for the safe and efficacious performance of concomitant SA for open atrial procedures (level of evidence A), as well as closed atrial procedures (level of evidence B) (3).

Nowadays, many left-sided valvular surgical procedures are being performed with the minimally invasive approach, hence concomitant Cox-Maze may not be always feasible in such context (16-18). Since the evidence from literature is relatively scarce, more studies are needed to establish which procedure is more appropriate in this setting. Recent developments in both technique and technology have enabled surgeons to perform the Cox-Maze procedure via right minithoracotomy (19). Robertson and colleagues

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reported a practical guide with complete steps of the lone Cox-Maze IV procedure performed through a right mini-thoracotomy (19). Furthermore, Kakuta and colleagues compared the outcomes of the modified biatrial SA via the right minithoracotomy approach with the sternotomy approach and reported 3-year cumulative incidences of recurrent AF in up to 23.1% patients (20). Interestingly, the authors found that ablation failure is more likely to occur at the tricuspid annulus where the surgical field of view is relatively poor (20). However, the West Virginia University group recently described robotic-assisted biatrial cryothermic Cox-Maze for persistent AF and reported greater than 90% 1-year longitudinal freedom from stroke, oral anticoagulation, repeat ablation, and recurrent AF (21).

In the recent issue of the *Journal of Thoracic Disease*, Kang and colleagues provided a single-centre retrospective study of long-term outcomes after concomitant SA for AF during redo left-sided valvular surgery in which they compared 73 patients who underwent concomitant SA with 151 who did not (22). They reported a better overall survival (HR: 0.452; P=0.032) and lower incidence of a composite of thromboembolism and major bleeding (HR: 0.338; P=0.029) after concomitant SA during redo left-sided valvular surgery after median follow-up of 10 years (22). Perioperative mortality was not negatively affected by adding concomitant SA (5.5% in the SA group *vs.* 9.3%, P=0.474) and early postoperative complications were comparable. The authors reported 47.9% freedom from AF after concomitant SA without increased risk of pacemaker implantation. The authors should be congratulated for satisfactory postoperative outcomes in this challenging and high-risk group of redo patients of which majority underwent left-sided double-valve surgery with simultaneous tricuspid valve surgery in up to 64.2% cases. Aortic cross-clamp time was approximately 15 minutes longer as compared to the cohort of patients without SA and the difference was not significant. The current contribution joins findings of many other studies, although with excluded redo cases, to clearly demonstrate that the addition of concomitant SA of AF improves long-term survival (2-4,7,11,13,15). Concomitant AF ablation during redo surgery can be particularly important in patients who are highly symptomatic from tachyarrhythmias, younger patients with limiting symptoms and those intolerant to antiarrhythmic or anticoagulant medications. Average age of patients who received SA in the current study was only 54 years (22). Another important contribution of this study is due to the fact there is still a lack of evidence on the safety and efficacy of the concomitant SA during the redo cardiac surgery (23). Stulak and colleagues reported a heterogeneous cohort of 245 patients, with a median age of 45 (range, 1 to 75) years, who underwent surgical treatment of concomitant atrial arrhythmias during redo cardiac surgery (23). In their experience, freedom from AF after a median follow-up of 4.1 years in the setting of congenital heart disease was 89% and in the setting of acquired heart disease was 78% (23). Since the choice of lesion set during a redo cardiac surgery depends heavily on intraoperative conditions and ease of the operation to the point of ablation, different ablation techniques and lesions were performed including isolated right-sided ablation, biatrial ablation, and right atrial isthmus ablation. Furthermore, Kobayashi and colleagues reported results of 42 selected patients who had a standard Cox-Maze procedure at the time of redo mitral valve surgery and experienced no deaths in the series, while sinus rhythm was restored in 67% of patients (24).

It is important to acknowledge the limitations of the study by Kang and colleagues, including its relatively small sample size, considering a long study period, for which reason propensity score matching was not feasible (22). More importantly, it would be interesting to understand more in detail how the authors selected patients for SA, and which lesions they performed since they described only that the type of SA was selected under surgeon's discretion. While in their cohort only 15.1% of patients in the SA group underwent tissue valve replacement, it seems that the majority of patients required to be on warfarin for the choice of prosthesis. Lastly, while the authors completed long-term follow-up (median 115 months) in 100% of patients, they did not have standardized follow-up with included 24-hour Holter monitor which makes it more difficult to interpret freedom from AF and antiarrhythmic medications. Another potential advantage for this long follow-up would be observation of stroke and type of bleeding events which is not reported in the current study. It would be also important to understand symptomatic improvement in addition to the survival benefit in the SA group since triple valve surgery was performed for most patients. Nevertheless, the authors highlighted an important point of lower incidence of the composite endpoint of thromboembolism and bleeding in patients who received concomitant SA procedure during redo cardiac surgery (22).

In conclusion, Kang and colleagues (22) provided an example of successful concomitant SA despite the medical complexity and risk of perioperative complications in this challenging context of redo cardiac surgery. Each patient

undergoing redo cardiac surgery has a unique clinical presentation and individual patient-tailored surgical strategy is crucial in attaining favourable results (25). This study highlights that concomitant SA could be beneficial in a selected patient cohort undergoing redo cardiac surgery and it should be considered even in this context when technically feasible. Recent evidence demonstrated that concomitant AF ablation during an already higher risk redo cardiac procedure can be performed with reasonable safety and success (23,24). It can be particularly valuable in younger or highly symptomatic patients, and those intolerant to antiarrhythmic or anticoagulant medications. The decision to perform SA for AF concomitantly with redo cardiac surgery depends on the intraoperative findings, including severity of adhesions and complexity of the cardiac repair. Alongside this, further studies with standardized ablation technique and follow-up are required in the context of redo cardiac surgery.

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