Minimally invasive Cox-maze procedure, beating-heart epicardial ablation, hybrid procedure and catheter ablation: a call for comparative evidence

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We read with great interest the paper by Je et al. [1] regarding minimally invasive surgical treatment for atrial fibrillation. This was a comprehensive systematic review pooling available data on the Cox-maze procedure, beating-heart epicardial ablation and hybrid procedure to compare their safety and efficacy. Based on 37 studies included in this review, Je et al. demonstrated that at 12-month follow-up, sinus rhythm restoration off antiarrhythmic drugs was 87, 72 and 71% for Cox-maze, epicardial and hybrid procedures, respectively. Similar trends were observed for sinus rhythm restoration on antiarrhythmic drugs (93, 80 and 70%, respectively). The authors concluded that minimally invasive Cox-maze procedure had the highest efficacy rates with acceptable mortality and morbidity at short- to mid-term follow-up.

One limitation correctly acknowledged in this study is the lack of studies directly comparing minimally invasive endocardial Cox-maze procedures with epicardial surgical ablation for stand-alone AF. This has hindered the ability to conduct meta-analyses and produce quantitative conclusions, thus highlighting the critical need for future randomized studies comparing these minimally invasive approaches. Prior meta-analyses published on this topic have demonstrated the efficacy of surgical ablation in cardiac and mitral valve surgery [2, 3], and provided comparative results for biatrial versus left-atrial lesion sets [4], and relative efficacy and safety of different energy sources [5]. One issue that has not been addressed in this systematic review is the efficacy and safety results of minimally invasive surgical ablation versus catheter ablation for AF treatment. In recent years, there have been an increasing number of comparative studies between minimally invasive endocardial ablation versus catheter ablation, particularly in the subset of patients with failed prior catheter ablation.

In the recent multicentre FAST study, Boersma et al. [6] conducted a randomized trial comparing catheter ablation (n = 63) with thoracoscopic epicardial surgical ablation (n = 61) in patients with prior failed catheter ablation or refractory AF with left atrial dilatation or hypertension. At 12-month follow-up, sinus restoration free from drugs was 65.6% for the surgical approach, significantly higher than 36.5% by the catheter approach. However, adverse events were significantly higher for the surgical group (34.4 vs 15.9%). These results provide optimistic data for the potential role of minimally invasive surgical ablation in the setting of patients with refractory AF with prior failed non-pharmacological intervention. However, the efficacy of thoracoscopic epicardial ablation in this setting versus other minimally invasive approaches such as Cox-maze and hybrid ablation procedure remains yet to be studied.

As such, we also propose randomized studies comparing Cox-maze, epicardial and hybrid procedures in the setting of prior failed intervention to further aid in clinical decision-making to provide optimal outcomes for patients. We are grateful for Je et al. [1] for sharing their experience, extensive analyses and valuable insights. Je et al. are to be commended for taking the initiative to consolidate the available evidence, which will serve as a solid platform for future research comparing minimally invasive endocardial and epicardial ablation techniques.

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LETTER TO THE EDITOR

Reply to Phan and Yan

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We thank Phan and Yan for their thoughtful comments on our study [1, 2]. As the authors rightly observe, we did not directly compare the safety and efficacy of surgical ablation and catheter ablation. Such a comparison was not the focus or the purpose of our systematic review, in which we compared all types of minimally invasive surgical ablation techniques to treat atrial fibrillation, including endocardial (i.e. Cox-maze), epicardial and the hybrid approach. We agree that recently published studies comparing epicardial with catheter ablation reflect an important area that is continuing to yield valuable insights into the safety and efficacy of these procedures.

Our review clearly demonstrates that, when cardiopulmonary bypass is utilized in such cases, safety is not compromised and efficacy may be significantly better even in more challenging patients such as those who generally present for off-pump surgical ablation. Therefore, the surgical community should be educated as to the level of discussion that takes place with patients and cardiologists and should consider all aspects of the procedure and not just avoidance of cardiopulmonary bypass.

As we point out in our review, the methodology used in the FAST trial [3] and the weight given to the importance of the increased rate of complications with surgical versus catheter ablation may be questionable. There is a possibility that the FAST findings may be overestimated by faulty design and incorrect labelling of complications by severity [3, 4]. We agree with Phan and Yan that more studies are needed in this area and should be pursued in future efforts comparing the safety and efficacy of the various operative approaches to the treatment of atrial fibrillation.

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Could the grade of the tumour be related to nodal involvement?

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Keywords: Sub-centimetre • Solid appearance • Prognosis • Lymph node metastases

We read the article of Hattori et al. [1] with great interest. We thank the authors for this well-designed study. Tumour node metastasis (TNM) staging is important for predicting the recurrence of the tumour and for survival. The authors mentioned that sub-centimetric pure solid nodules with high SUVmax values have a tendency toward lymph node metastasis. Also, the invasiveness of the tumour is declared to be an important determinant of recurrence and survival [2]. In this context, we think that the differentiation degree of the tumour may be a prognostic factor in lung cancer. As a result, we recommend lobectomy for high-grade sub-centimetric nodules.

Evaluation of the sub-centimetric nodules with PET scans may be misleading [3]. Too many centres do not perform a PET scan for nodules smaller than 1 cm because of high ratio of false-negative results. So, we think that the invasiveness and the grade of the tumour may be directive for whether to perform limited resection or lobectomy in these nodules. In this context, a histopathological decision is thought to be more reliable than PET scan results.

As a final comment, we think that grade of the tumour will be a component in the staging system of lung cancer over time, that is, in oesophageal cancer staging.

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Reply to Cubuk and Yucel

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We are really grateful to the letter by Cubuk and Yucel [1] regarding our recent study [2], and we are delighted by their thoughtful insights into our results.

Owing to the recent improvements in thin-section computed tomography (CT), smaller and fainter lung cancers, including sub-centimetre lung cancers, are being discovered in recent practice. Of these, lung adenocarcinomas showing a wide area of ground-grass opacity (GGO) are considered to have a good prognosis and, in most cases, their pathological features are minimally invasive [3]. Traditionally, however, postoperative nodal involvement is found in ~15–20% of cases even in patients with clinical stage IA NSCLC showing a radiologically solid appearance [4, 5]. Therefore, radiologically determined solid lung cancer was considered to have more malignant potential compared with a tumour with GGO component, regardless of how small it is. These observations clearly indicated that ‘tumour size less than 1 cm’ does not indicate the absence of tumour spread, and limited resection should not necessarily be indicated even for solid sub-centimetre lesions, especially in patients with high SUVmax and a radiological pure-solid appearance on thin-section CT [2].

As mentioned by the authors, the invasiveness of the tumour is declared to be an important determinant of recurrence and survival. In this context, the differentiation degree of the tumour could be a prognostic factor in lung cancer, and the authors recommended lobectomy for pathologically high-grade tumours in sub-centimetre nodules. However, the intraoperative evaluation of pathological tumour differentiation appears to be difficult to be routinely performed in clinical practice. Our study focuses on analyses that predict pathological invasiveness based on the nodal metastaases. This is because only clinical predictors can determine the proper surgical modes. In these contexts, we believe that radiological findings and SUVmax level are the useful clinical predictors of pathological nodal involvement. From this result, a thorough intraoperative evaluation of lymph nodes is needed to prevent loco-regional failure, if limited surgery is indicated for solid sub-centimetre lung cancer.

The role of FDG-PET in the evaluation of sub-centimetre lesions remains unclear [6]. Based on our study, however, FDG-PET is expected to be effective for predicting postoperative lymph node involvement and loco-regional recurrence in some selected patients with sub-centimetre lung cancer showing a pure-solid appearance on thin-section CT, because of the possibility that they are sensitive to FDG due to their invasive nature [2].

Finally, even in cases of sub-centimetre lung cancer, lymph node metastasis is frequently observed in patients with radiologically pure-solid nodule, especially for tumours that show a high SUVmax. Hopefully, our study will pave the way for a more refined treatment strategy in dealing with sub-centimetre lung cancer.

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