

Peer Review File

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Reviewer A

C1: In page 14, line 273: Please introduce current recommendations of the hybrid or surgical approach for AF treatment in other society guidelines such as HRS/APHRS (Heart Rhythm. 2017;14:e275-e444) in addition to the ESC guidelines. Also mention an updated JCS/JHRS guidelines (Circ J. 2021;85:1104-1244) in which the authors may belong to.

R1: Thank you for your valuable input. We have incorporated recommendations for hybrid ablation and surgical ablation from guidelines in Europe, the United States, and Japan.

In summary:

According to the ESC guideline, concomitant surgical AF ablation is classified as class IIa, while hybrid ablation holds a class IIa or IIb recommendation. It is specifically indicated as class IIa for patients with a history of failed catheter ablation for anti-arrhythmic drug-refractory AF.

The latest 2023 ACC/AHA/ACCP/HRS guideline suggests a class IIa recommendation for concomitant surgical ablation during cardiac surgery and a class IIb recommendation for hybrid ablation.

In the JCS/JHRS guideline, concomitant surgical ablation receives a class I recommendation, and stand-alone surgical ablation is categorized as class IIa for patients with symptomatic AF without structural heart disease and those with AF after catheter ablation. However, there is no specific recommendation regarding hybrid ablation.

The aforementioned information has been incorporated into the manuscript. (Lines306-314)

C2: A representative case 1 in Figure 2 was nicely presented. Could you show this case was a stand-alone surgical ablation for AF, or an ablation concomitant with other surgical repairs? Please specify.

R2: Thank you for your feedback. Figures 2 and 3 both depict cases of stand-alone surgical ablation with left atrial appendage excision. This information has been included in the figure legends. (Line678 and 695)

Reviewer B

C3: The method of this study needs to reference any study of more recent years. This article does not have any clinical impact.

R3: Thank you for your feedback. We have revised the manuscript to incorporate citations from more recent studies, including the LAAO-III trial and CEASE-AF trial, as well as the latest guidelines.

Reviewer C

C4: You performed a systematic search, yet deemed your review as “Narrative”. How did you decide to use those disparate designations?

R4: Thank you for your comment. We have revised the methods section to include additional details on our article search. It is important to note that the manuscript is categorized as a narrative review, not a systematic review, as you pointed out. (Lines 106-116)

C5: On lines 61-62, please clarify what you mean by: “and left atrial appendage of hybrid ablation”. On line 207 you’ve written excising or closing the left atrial appendage, suggesting you should change this to “and left atrial appendage excision or closure during hybrid ablation.

R5: Thank you for your comment. We have made the necessary modifications to the manuscript as suggested. (Lines 62-63)

C6: On line 93, change: “time” to “times”.

R6: Thank you for your feedback. As recommended, we have replaced "time" with "times." (Line 94)

C7: On line 118, the word “output” is nonspecific. Please clarify.

R7: Thank you for your feedback. The term "output" refers to the applied radiofrequency power. We have revised the manuscript to provide clarification on the meaning of the word "output." (Line 125)

C8: On line 131, change: “even” to “modality, even”.

R8: Thank you for your comment. We have modified the manuscript, as suggested. (Line141)

C9: On line 133, change: “recurrence” to “the recurrence”.

R9: Thank you for pointing out the grammatical error. We have made the necessary corrections in the manuscript. (Line143)

C10: On lines 163-164, change: “The left atrial posterior wall is an embryologically same origin with the pulmonary veins” to “The embryological origin of the left atrial posterior wall is similar to that of the pulmonary veins”.

R10: Thank you for your suggested. We have modified the manuscript, as requested. (Lines 180-181)

C11: On line 168, delete: “JM”.

R11: Thank you for your comment. We have removed "JM" as suggested. (Line 184)

C12: On line 171, change “it” to “maintenance of sinus rhythm”.

R12: Thank you for your comment. We have modified the manuscript, as suggested. (Line 188)

C13: On line 185, delete: “the”.

R13: Thank you for pointing out the grammatical error. We have deleted “the”, as suggested. (Lines 250-251)

C14: On line 191-193, change: “This necessitates an insufficient RF application to avoid complications such as left atrial-esophageal fistulas, which can affect the success and recurrence rates of posterior wall isolation” to “This may result in insufficient RF energy application (to avoid complications such as left atrial-esophageal fistulas) and failure to achieve permanent posterior wall isolation”.

R14: Thank you for your comment. We have modified the manuscript, as suggested. (Line 208-210)

C15: On line 194, change: “cryo energy or pulse field ablation” to “cryothermal or pulsed field ablation”.

R15: Thank you for your comment. We have modified the manuscript, as suggested. (Line 211)

C16: On line 200, change: “pulse field ablation” to “pulsed field ablation”.

R16: Thank you for your comment. We have revised the term to "pulsed field ablation" as recommended. (Line 217)

C17: On line 206, change: “In the hybrid ablation” to “In hybrid ablation”.

R17: Thank you for your comment. We have removed "the" as suggested. (Line 279-280)

C18: On line 214, change: “entire” to “comprehensive”.

R18: Thank you for your comment. We have made the necessary edits to the manuscript as suggested. (Line 230)

C19: On line 217, change: “superior vena cava or” to “superior vena cava”.

R19: Thank you for pointing out the grammatical error. We have deleted “or”. (Line 233)

C20: On line 307, change: “pulsed field ablation, catheter-based” to “pulsed field catheter-based”.

R20: Thank you for your comment. We have modified the manuscript, as suggested. (Lines 350-351)

C21: On lines 309-310, change: “The floor line often becomes an insufficient RF application. when performing endocardial posterior wall isolation to avoid atrio-esophageal fistula” to “In order to avoid atrio-esophageal fistula formation, the floor line often receives insufficient RF application when performing endocardial posterior wall isolation”.

R21: Thank you for your comment. We have modified the manuscript, as suggested. (Lines 353-354)

C22: On line 310, delete: “the”.

R22: Thank you for pointing out the grammatical error. We have deleted “the”. (Lines 354)

C23: On line 312, change: “posterior” to “posterior wall” and “This” to “Thus”.

R23: Thank you for your comment. We have modified the manuscript, as suggested. (Line 356)

C24: On line 349, change: “PV” to “AF”.

R24: Thank you for pointing out the error. We have changed “PV” to “AF”. (Line 452)

C25: In the figure 2 legend, change: “uncommon” to “atypical”.

R25: As suggested, we have changed “uncommon” to “atypical” (Line 682)

C26: In the figure 3 legend, line 562, change: “staged ablation” to “staged catheter ablation”.

R26: Thank you for your comment. We have modified the figure 3 legend, as suggested. (Line 695)

C27: On lines 76-77, change: “RF catheter ablation has been used to treat atrioventricular nodal reentrant tachycardia or Wolff-Parkinson-White syndrome” to “RF catheter ablation has been used to treat atrioventricular nodal reentrant tachycardia, accessory pathway mediated tachycardias, atrial tachycardia, atrial flutter and ventricular arrhythmias”.

R27: Thank you for your comment. We have modified the manuscript, as suggested. (Lines 75-77)

C28: On lines 85-86, please note that that the first Cox-maze procedure was performed in 1987.

R28: Thank you for pointing out the important point. We have modified the manuscript, as suggested. (Line 86)

C29: On lines 89-90, change: “The development of devices, such as those with cryo-energy” to The use of ablative energy sources such as radiofrequency and cryoablation”.

R29: Thank you for your comment. We have modified the manuscript, as suggested. (Lines 89-90)

C30: On line 90, when cut and sew was replaced the procedure became known as the Cox-maze IV.

R30: Thank you for your helpful comment. We have made the necessary modification to the manuscript to clarify that the non-incisional surgical treatment is known as the Cox-Maze IV procedure. (Line 91)

C31: On lines 121-122, how does a 3D mapping system assess lesion quality?

R31: Thank you for your comment. Specifically, the 3D mapping system is capable of estimating lesion volume rather than assessing lesion quality. For instance, the CARTO system offers the ablation index as an indicator of lesion volume, while the EnSite system provides the lesion size index. In the case of the Rhythmia system, it utilizes the local impedance measured by the ablation catheter as an indicator of lesion volume. We have incorporated this information into the manuscript. (Lines 125-128)

C32: On lines 218-219, you have written: “Some non-PV foci, such as those originating from the coronary sinus ostium and atrial septum, cannot be eliminated with anatomical ablation”. Are you certain this is correct? Maze procedures include ablation of the coronary sinus (see: N Engl J Med 2015; 373:483-484).

R32: We completely agree with your comment. We have removed the sentence you highlighted. Instead, we added a sentence addressing the lesion durability of PVI and the posterior wall isolation line after endocardial catheter ablation, which is inferior compared to surgical ablation. (Lines 234-236 and 344-350)

Reviewer D

C33: Thank you for the opportunity to review this manuscript. The authors have submitted a narrative review discussing an interesting and important topic of hybrid ablation for persistent atrial fibrillation. The manuscript is well-written and provides a comprehensive discussion on this topic, including 2 representative cases.

R33: We greatly appreciate your effort in reviewing the manuscript and providing thoughtful comments.

Reviewer E

C34: Introduction- Lines 93-95, it is not correct to say that “treatment outcome are not satisfactory yet” for surgical ablation in cases of non-paroxysmal AF. This mile-stone paper is one of the proofs: J Thorac Cardiovasc Surg. 2022 February ; 163(2): 629–641.e7. doi:10.1016/j.jtcvs.2020.04.100.

R34: We acknowledge your comment. As you highlighted, the COX-MAZE IV procedure for non-paroxysmal AF demonstrates favorable outcomes. We have revised the sentence in the Introduction accordingly. Moreover, we have included the paper you recommended in the Introduction.

C35: Outcome after Catheter Ablation for Persistent Atrial Fibrillation - I suggest discussing this meta-analysis on long-term outcomes of catheter ablation and focusing on persistent AF: Eur Heart J Qual Care Clin Outcomes. 2023 Aug 7;9(5):447-458. doi: 10.1093/ehjqcco/qcad037.

R35: We appreciate the reviewer's suggestion of the referenced article. We have included the suggested article and made the necessary modifications to the manuscript.

C36: Outcomes after Hybrid Ablation for Atrial Fibrillation - Line 206, rather than just “independently” I would suggest to use “independently but complementary” or similar.

R36: As you suggested, cardiac surgeons and EP doctors contribute independently but complementarily to hybrid ablation. We have updated the manuscript accordingly.

C37: Lines 208-210, reference to the LAAOS III trial or the just released AHA/ACC/HRS 2023 guidelines should be added, as LAA closure in patient with AF and CHA₂DS₂-VASc ≥ 2 undergoing cardiac surgery is a class I recommendation.

R37: Thank you for your helpful comment. We have cited the LAAOS III trial and referenced the latest guideline in 'Intervention for Left Atrial Appendage in Hybrid Ablation,' as mentioned in R39.

C38: - Lines 305-306, this sentence is ambiguous and should be rephrased. All current meta-analyses have shown that minimally invasive surgical AF ablation has superior outcomes when compared to catheter ablation, but with higher complication rates (as correctly discussed later on by the Authors).

R38: Thank you for your feedback. We have removed the sentence you highlighted and added information regarding the lesion durability of PVI and the posterior wall isolation line after endocardial catheter ablation, emphasizing its inferiority compared to surgical ablation.

C39: Intervention for Left Atrial Appendage in Hybrid Ablation- Brief discussion on the LAAOS III trial and the just recent upgrade of surgical LAA occlusion in the American guidelines should be added.

R39: Thank you for your helpful comment. In response, we have included a brief description of the LAAOS III trial. Additionally, we cited the latest guidelines to underscore the effectiveness of surgical LAA closure.

Reviewer F

C40: the authors write: Methods: To investigate the treatment outcomes of hybrid ablation for AF, a systematic search was conducted on PubMed for English literature using the terms "hybrid ablation" and "atrial fibrillation." Thirty-one studies, including clinical trials, randomized controlled trials, meta-analyses, and systematic reviews since 2010, were identified. I do not really see the point to mention this if you do nothing particular with the search but writing a narrative review. At least the identified studies could be mentioned and the info deducted from these studies, in a table e.g., otherwise this information does not really add something to the paper

-following on this, the review is not more than narrative and therefore does not really add something new to the amount of literature present. More reviews have been published and not any form of analysis is presented in this study.

R40: Thank you for your comment. We agree with your feedback. As mentioned in R4 and R49, we have revised the method section to provide a clearer description of the literature search method, and we have included a table for better clarity. (Lines 106-116)

C41: -throughout the paper it should be more specified what the authors are talking about, e.g. PVI can both be performed transcatheter endocardially or thoroscopically epicardially

R41: Thank you for your comment. We have modified the conclusions. (Lines 465-476)

C42: -there is a difference between thorascopic and subxiphoid hybrid AF ablation, this should be described (pros and cons) more in detail including the difference in success rate

R42: Thank you for your feedback to enhance the manuscript. The suggested topic regarding the difference between thorascopic and subxiphoid hybrid AF ablation has been incorporated into the manuscript. (Lines 362-396)

C43: PFA is a new kid on the block, at least it should shortly be discussed in this review.

R43: Thank you for your feedback. We have revised the manuscript by minimizing the description of PFA. The importance of PFA as an energy source for posterior wall isolation is emphasized, highlighting its role in avoiding esophageal injury, which can significantly impact treatment outcomes in patients with persistent AF undergoing posterior wall isolation. The revised manuscript now provides a concise description, specifically focusing on posterior wall isolation using PFA. (Lines 216-219)

C44: -The literature search seems incomplete, only 1 paper of the Maastricht group (leading in hybrid Af ablation) is referenced and the important CEASE -AF trial is not mentioned

R44: Thank you for your valuable comment to enhance the quality of our manuscript. We have incorporated references to the meta-analysis from the Maastricht group and the CEASE-AF trial. (Lines 276-283 and 294-303)

C45: -the message of the review is not clear, what is your conclusion based on your literature review?

R45: As mentioned in R41, we have modified the conclusions. (Lines 465-476)

C46: - there are several ways to thoracoscopically isolate the posterior wall, these are not addressed

R46: Thank you for bringing attention to a crucial aspect related to the methods employed for thoracoscopically isolating the posterior wall. We have incorporated information from the JACC review (JACC 2023;81:606–619) on the techniques for posterior wall isolation in hybrid ablation, encompassing 1) the posterior box (single ring), 2) PVI with connecting roof and floor lines, and 3) posterior left atrial ablation. The revised manuscript now details the method of posterior wall isolation during hybrid ablation. (Lines 362-396)

C47: -the van der heijden meta-analysis on hybrid vs catheter ablation should be discussed regarding the difference in complication rate

R47: Thank you for your suggestion. We have cited the van der Heijden meta-analysis and made the necessary modifications to the manuscript. (Lines 404-411)

C48: Fig 2 and 3 are not really making the paper stronger, consider other figures

R48: Thank you for your comment. Some of the other reviewers have appreciated the voltage map of staged catheter ablation after surgical ablation, considering it contributes to improving the quality of this manuscript. We believe that Figures 2 and 3, especially for electrophysiologists who may lack experience or have limited experience of hybrid ablation, provide valuable information.