

Article type: Letter to the Editor

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Conflict of Interest: EK declares equity interest in Attune Medical; MM performs consulting for, and SS is an Operations and Quality Engineer for Attune Medical.

To the Editor: Re: Comparative study of strategies to prevent esophageal and periesophageal injury during atrial fibrillation ablation

We have read with great interest the article entitled “Comparative study of strategies to prevent esophageal and periesophageal injury during atrial fibrillation ablation.”, {de Oliveira, 2020 #6876} and congratulate the authors for their work. This study brings additional insights into preventing esophageal injuries during atrial fibrillation ablation, and we are interested in understanding some further details.

As the authors point out, the power delivered to the treatment arm (50 W for 20 sec per application) was significantly greater than in controls, and was based in part on findings from an earlier study; however, this is generally more than used in most current practices, and it isn't clear if this is standard at the authors' institution. Likewise, the imbalance of left atrium–esophagus distance between groups makes conclusions on cooling efficacy more difficult. We believe a significant influence that was not discussed is the overall heat extraction capacity of the system investigated. In contrast to a currently commercially available system that utilizes coolant flow rates of 1833 mL/minute to 2400 mL/minute, {Kalasbail, 2018 #6324} {Montoya, 2019 #6610} the system reported here utilized dramatically lower flow rates of 17 mL/minute. Have the authors performed measurements of temperature of inflow and outflow, in order to determine total heat transfer capacity? At the flow rates studied, it would be interesting to ascertain whether outflow temperatures may have risen to the point that heat transfer from the esophageal wall to the device wall may have diminished, and if so, to what extent did the heat transfer capacity decrease. For example, if inflow water temperature was $8^{\circ}\pm 2^{\circ}\text{C}$, a gradient of up to 30°C would exist to drive thermal flow from esophagus to device, but if a slow flow rate permitted water temperature to rise by 10°C – 20°C during transit through the balloon, then up to two-thirds of the thermal driving force would be lost. This loss would of course directly reduce the efficacy against esophageal thermal injury, and knowledge of this factor may help in next steps towards further investigating this approach. The authors could use numerical modeling and simulation in order to perform in silico experiments that could lead to a better understanding of the phenomena involved, as well as reinforcing the clinical data and making further predictions.

References:

1. de Oliveira BD, Oyama H, Hardy CA, de Melo SL, Pisani CF, Chokr MO, Balbo C, da Costa Darrieux FC, Hachul DT, Chaves DM, de Almeida Artifon EL, Cestari IA, Sakai P, Scanavacca MI: Comparative study of strategies to prevent esophageal and periesophageal injury during atrial fibrillation ablation. *J Cardiovasc Electrophysiol* 2020, 31(4):924-933 PMID: 32108399.
2. Kalasbail P, Makarova N, Garrett F, Sessler DI: Heating and Cooling Rates With an Esophageal Heat Exchange System. *Anesth Analg* 2018, 126(4):1190-1195 PMID: 29283916.
3. Montoya MM, Mickelsen S, Clark B, Arnold M, Hanks J, Sauter E, Kulstad E: Protecting the esophagus from thermal injury during radiofrequency ablation with an esophageal cooling device. *Journal of atrial fibrillation* 2019, 11(5):2110 PMID: 31139296.