

# Esophageal Cooling and the Incidence of Severe Ulcers in Patients Undergoing Ablations for Atrial Fibrillation

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### INTRODUCTION

- Atrial fibrillation (AF) affects 33.5 million people, 2% of the global population<sup>1</sup>
- Radiofrequency ablation (RFA) uses heat to create a lesion around the ostia of the pulmonary veins and isolate the AF foci<sup>2,3</sup>
- Thermal energy can extend transmurally beyond the ostia in the endocardium and cause injury to nearby structures (figure 1) leading to esophageal injuries that range from mild erythema to severe ulceration and atrial-esophageal fistulas (AEF) that may be fatal<sup>1,3,4</sup>
- Esophageal cooling during RFA reduces heat transfer from the left atrium (LA) to the adjacent esophageal tissue (figure 2)
- The purpose of this integrative review is to assess effectiveness of esophageal cooling in the prevention of severe esophageal ulcers and injury from RFA
- PICOT:** In adult patients underdoing RFA for AF, does the use of esophageal cooling compared to no esophageal cooling affect the incidence of esophageal injury diagnosed by esophagogastroduodenoscopy (EGD) 24 hours to 7 days after the procedure?

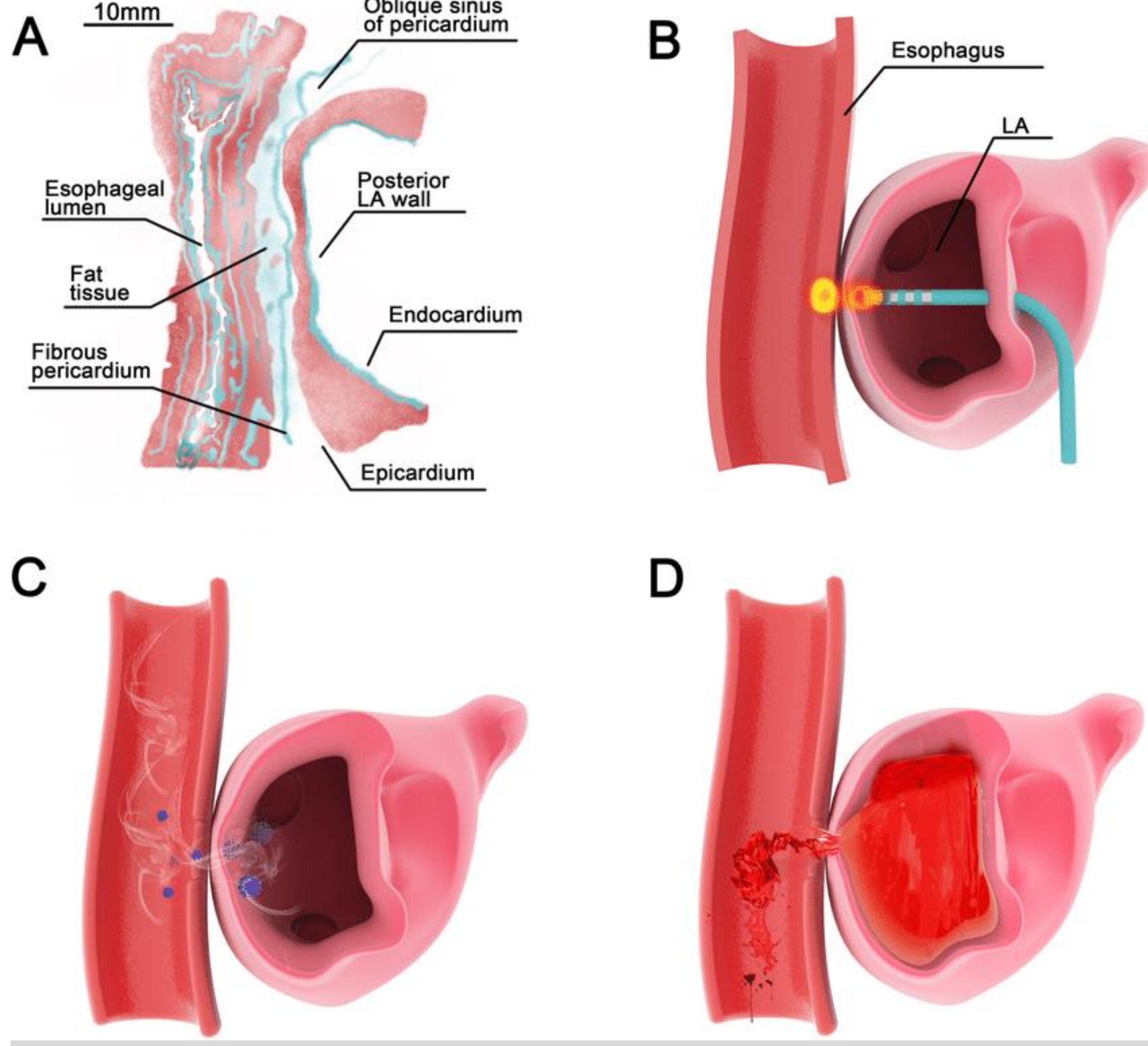
### METHODS

- Databases: PubMed, Medline Complete, and Embase
- Keywords: *esophageal cooling, atrial fibrillation, radiofrequency ablation, and esophageal ulcer*
- Limits: English-only and adults
- Search yielded 74 related results
- Highest levels of evidence: 2 systematic reviews with meta-analysis (SRMA) and 1 retrospective observational review (ROR)
- IRB/IACUC approval does not apply to this evidence-based project.

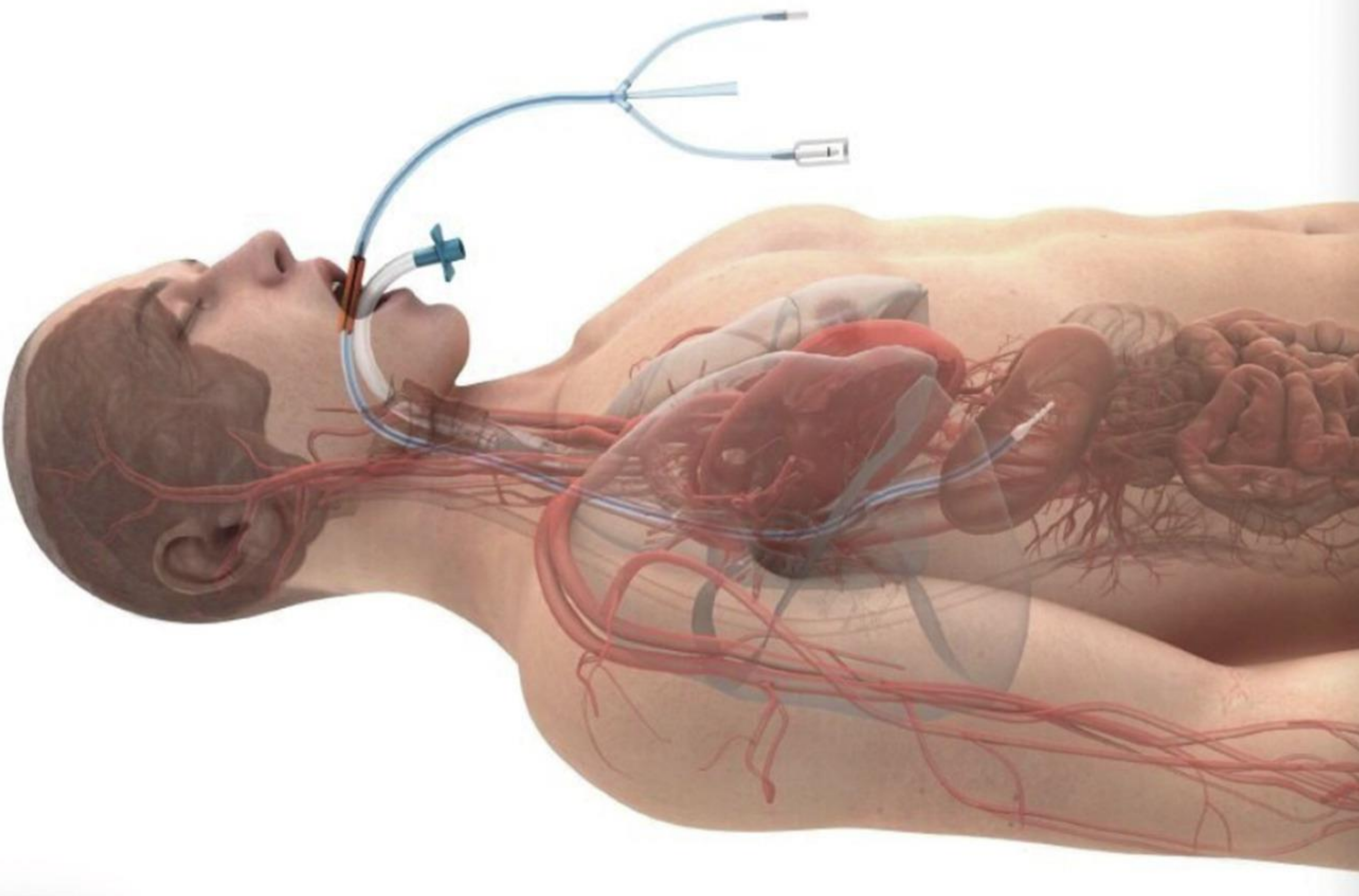
### REVIEW of LITERATURE / CRITICAL APPRAISAL

- 2 SRMAs and 1 ROR report esophageal cooling significantly reduced the incidence of severe esophageal injuries, ulcers, and AEFs<sup>3,4,5</sup>
- 2 SRMAs report esophageal cooling had no effect on the overall incidence of esophageal injury
- No significant differences in the incidence of mild esophageal injury between cooling and no treatment groups (table 1)<sup>3,4</sup>
- There are no reported adverse events with esophageal cooling<sup>3,4,5</sup>
- The synthesis of the data partially supported cooling, finding esophageal cooling to be effective at reducing the incidence of severe esophageal injuries although the incidence of mild to moderate injury was unaffected<sup>3,4</sup>
- Gaps in the research include the need for standardization regarding devices used, optimal timing of cooling, and timing of post-op EGDs to identify factors that may prevent mild-to-moderate injury.

# Esophageal cooling reduces the incidence of severe esophageal ulcers in patients undergoing radiofrequency ablations



**Figure 1.** Development of an Atrial-esophageal Fistula with Radiofrequency Ablation. (A) Histological diagram displaying proximity of esophagus to left atrial (LA) wall, (B) thermal injury at atrial esophageal junction with radiofrequency ablation, (C) open communication between atrial and esophagus, (D) blood lost via atria to esophagus<sup>6</sup>



**Figure 2.** Placement of silicone tube continuously circulating water at 4 °C into the esophagus<sup>5</sup>

Author, Study Design	Sample (N)	Cooling Device	EGD Timing	Cooling vs No Cooling Results
Leung et al, <sup>3</sup> 2020	N = 494 1 RCT 2 POR	Orogastric tube with ice cold NS	Within 24 h	Cooling had no effect on the overall incidence of esophageal lesions OR 0.6 (95% CI 0.15-2.38), P = .4
SRMA		Orogastric tube with ice water	Within 24 h	Cooling reduced the incidence of high-grade lesions and ulcers OR 0.39 (95% CI 0.17-0.89), P = .02
		Orogastric tube with NS-contrast medium at 10 °C	1-3 days	
Hamed et al, <sup>4</sup> 2023	N = 294 4 RCTs	Orogastric tube with ice water	Within 24 h	Cooling had no effect on the overall incidence of esophageal injury OR 0.86 (95% CI 0.31-2.51), P = .78
SRMA		Balloon catheter with cold water saline	1-3 days	Cooling was associated with a lower risk of severe esophageal injury and ulcers OR 0.21 (95% CI 0.05-0.80), P = .02
		Silicone tube, circulating water at 4 °C	1-7 days	
ROR	N = 14,224	Silicone tube, circulating water at 4 °C	Within 48 h	Adoption of cooling decreased AEF rate from 0.146% to 0%, P = <.0001

**Table 1.** Incidence of Esophageal Injury Associated with Esophageal Cooling vs No Cooling  
 Abbreviations: AEF, atrial-esophageal fistula; EGD, esophagogastroduodenoscopy; NS, normal saline; OR, odds ratio; POR, prospective observational review; RCT, randomized controlled trial; SRMA, systematic review and meta-analysis; ROR, retrospective observational review

### RECOMMENDATIONS for PRACTICE / CONCLUSIONS

- Esophageal cooling prevents severe esophageal injury but has no effect on the overall incidence of esophageal injury<sup>3,4,5</sup>
- Various forms of esophageal cooling are available, and all were found to be effective in reducing incidence of several esophageal injury<sup>3,4,5</sup>
- In adults undergoing RFA for AF, esophageal cooling does significantly decrease the incidence of esophageal ulcers within 24 hours – 7 days as diagnosed by EGD<sup>3,4,5</sup>
- Based on the data, all patients undergoing RFA for AF should receive esophageal cooling to prevent severe ulceration and fatal complications
- Future research considerations include cost-effectiveness in methods of cooling, identifying patient-specific risk factors, and use in post-op treatment of esophageal injury
- Esophageal cooling is a novel yet simple approach, within the anesthesia providers' skillset, that requires minimal additional training



### REFERENCES

