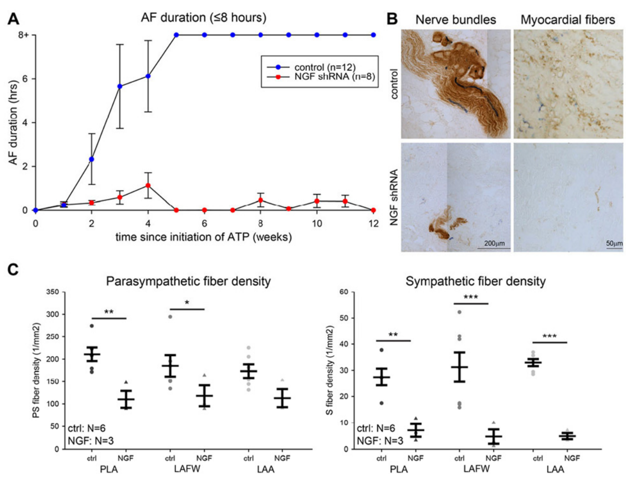
Results: After initiation of RAP, control animals developed persistent atrial fibrillation (>8 hours) after a median of 14 days. In contrast, NGF shRNA animals never developed this burden of AF over the duration of the study. Residual AF recorded at time of terminal EP study was slower (lower dominant frequency; PLA: 10.5±0.8Hz Vs 11.0±0.7Hz; LAFW: 9.7±0.8Hz Vs 10.4±0.7Hz; LAA: 8.8±0.5Hz Vs 9.9±0.5Hz; two-way ANOVA $p<0.001$), less fractionated (longer fractionation interval; PLA: 80.4±8.1ms Vs 68.1±5.2ms; LAFW: 79.3±9.3ms Vs 70.9±3.1ms; LAA: 87.9±7.8ms Vs 80.3±2.0ms; two-way ANOVA $p<0.001$) and more organized (higher organization index and lower Shannon's entropy). Tissue analysis showed that RAP induced hypertrophy of nerve bundles was significantly attenuated in dogs receiving NGF shRNA. This decrease in bundle size was accompanied by a significant decrease in parasympathetic and sympathetic fibers in the atrial myocardium.
Conclusion: Targeted inhibition of atrial autonomic remodeling by NGF shRNA prevents development of persistent AF. Future optimization of this approach may lead to a novel, mechanism-guided therapy for AF.



ABSTRACT CA-528: Experimental and Clinical Research into Esophageal Protection from Ablation Related Injury

Friday, April 29, 2022
9:15 AM - 10:15 AM

CA-528-01

PATTERNS OF ESOPHAGEAL TEMPERATURE CHANGE PREDICT ESOPHAGEAL THERMAL INJURY IN CATHETER ABLATION FOR ATRIAL FIBRILLATION

Tanzina Afroze; Yaacoub Chahine; Fima Macheret; Mahbod Jafarvand; Patrick Boyle and Nazem Akoum

Background: Esophageal luminal temperature (ELT) monitoring during catheter ablation for atrial fibrillation (AF) is widely used to reduce the incidence of esophageal thermal injury (ETI).
Objective: We investigated whether specific patterns of temperature variation are associated with ETI.
Methods: We conducted an observational study on patients with paroxysmal or persistent AF undergoing radiofrequency (RF) or cryoballoon ablation (CBA) at the University of Washington between September 2019 and November 2021. The CIRCA-S multi-sensor probe (Circa Scientific) (panel A) was used to record high-fidelity ELT. Patients underwent upper endoscopy one day after ablation. ELT data were analyzed for patterns associated with ETI, including maximum and minimum temperature, number of peaks above 37°C (panel B), troughs below 30°C (panel C), number of spikes, area under the temperature curve (panel D).
Results: A total of 78 patients (61.5% paroxysmal AF; 30.8% female) were included. Among them, 61 patients underwent RF, and 17 patients CBA. ETI was detected in 10 patients (12.8%). Patients with ETI had a higher number of peaks or troughs recorded (3.3±1.7 vs. 2.25±1.11, $p=0.041$) and a lower area under the curve (632.9±681.27 vs. 1393.44±1761.97, $p=0.038$). Logistic regression analysis revealed that the total number of peaks/troughs was associated with an odds ratio [OR]: 1.78 for increased risk of ETI (confidence interval [CI]: 1.1 - 2.87; $p=0.02$), while the area under the curve's OR was 1.65; ([CI]: 1.01 -2.72; $p=0.048$).
Conclusion: The number of peaks/troughs and the area under the temperature curve recorded during ELT are associated with an increased risk of ETI. Prospective studies guided by these parameters are needed to demonstrate their efficacy in reducing ETI.

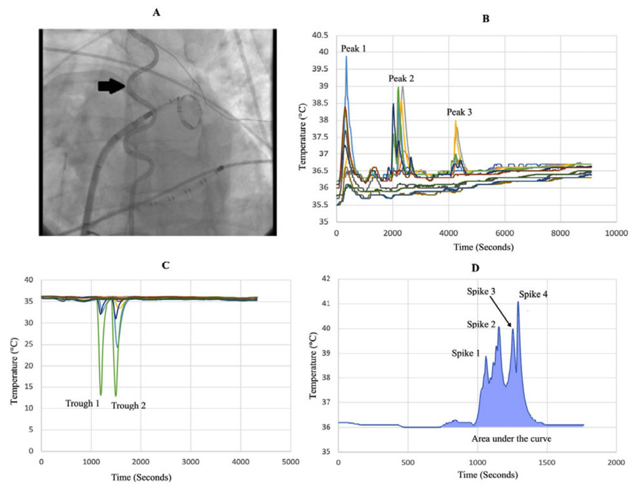


Figure 1: Fluoroscopic image of CIRCA-S multi-sensor probe and esophageal luminal temperature patterns. Fluoroscopic image of CIRCA-S multi-sensor probe (**A**); peaks (fluctuation of temperature above 37 °C in RF, recorded by multiple thermistors) (**B**); troughs (fluctuation of temperature below 30 °C in CBA, recorded by multiple thermistors) (**C**); spikes (number of times temperature fluctuates before reaching the baseline, recorded by single thermistor) (**D**).

CA-528-02

SHORT-TERM NATURAL COURSE OF ESOPHAGEAL THERMAL INJURY AFTER RADIOFREQUENCY CATHETER ABLATION FOR ATRIAL FIBRILLATION

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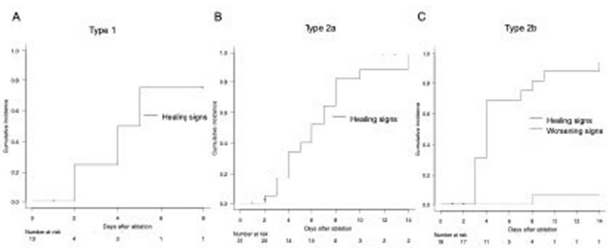
Background: Although esophagogastroduodenoscopy (EGD) is a good modality for assessing post ablation esophageal thermal injury (ETI), few details are known about the short-term healing or progression of esophageal injury.
Objective: Provide further insight into the short-term natural history of ETI and clinical outcome based upon repeated EGD imaging with use guided by late-gadolinium enhancement magnetic resonance imaging (LGE MRI).
Methods: A retrospective analysis of 378 patients who underwent EGD based on the findings on the esophagus by post-ablation LGE MRI imaging after left atrium radiofrequency ablation for atrial fibrillation from 2010-2019 at our institution. We defined ETI according to the Kansas City classification (type 1: erythema, 2a: superficial ulcers, 2b: deep ulcers, 3a: perforation without communication with the atria, 3b: perforation with

atrioesophageal fistula, AEF). Repeated EGD was performed within 1-14 days after the first EGD until healing signs were observed.
Results: Esophageal lesions were detected by initial EGD in 62 patients (mean age; 64.2 ± 13.0, female; 43.5%, 21%; type 1, 50%; type 2a, 29%; type 2b) and 43 patients underwent repeated EGDs. In these 43 patients, all lesions showed healing signs in repeated EGD within 14 days after ablation but one type 2b lesion which showed enlarging injury in repeated EGD and finally developed into an AEF.
Conclusion: We showed that all ETIs which did not progress to AEF showed signs of healing in repeated EGD within 14 days after the procedure. Worsening ETI diagnosed by repeated EGD may be a sign for developing esophageal perforation and provide the basis for more aggressive treatment strategy to lower risk of AEF.



Cumulative incidence of healing and worsening signs of esophageal injury in follow-up EGD based on the severity of esophageal injury with panel (A) for Type 1, panel (B) for Type 2a and panel (C) for Type 2b. Type 2b was the most serious injury seen in our cohort. Black curve represents cumulative incidence of patients who represented healing signs in follow-up EGD, and the red represents that of patients who represented worsening signs, respectively. The event of worsening signs was treated as a competing event of healing signs. Vertical tick marks indicate right-censored patients.

CA-528-03

A REGISTRY REVIEW UPDATE OF 7120 CATHETER ABLATIONS FOR ATRIAL FIBRILLATION USING A DEDICATED ESOPHAGEAL TEMPERATURE CONTROL DEVICE FOR PROTECTION

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Background: Esophageal protection using a dedicated device to provide controlled active thermal protection of the esophagus during atrial fibrillation ablation has been shown to be effective. Randomized evidence from the IMPACT trial showed an 83.4% reduction in endoscopically detected esophageal lesions compared to standard care. Real world registry data of this device has been under review.
Objective: To determine the safety of an esophageal temperature control device by an updated review of real-world registry data on its clinical use and any reported device-related adverse events.
Methods: The following databases were reviewed for any reported esophageal temperature control device-related complications: The United States Food and Drug Administration (FDA) Manufacturer and User Facility Device Experience (MAUDE), FDA Medical and Radiation Emitting Device Recalls, the Medicines and Healthcare products Regulatory Agency (MHRA) Medical Device Alerts and SwissMedic records of Field Safety Corrective Actions (FSCA). An internal registry (post-marketing follow up) database maintained by the manufacturer of the device was used to quantify the number used for each indication. Reported events underwent an updated review including any instances of device-related adverse events when used during catheter ablations.
Results: Of the **20,000** oesophageal temperature control devices used, **7120** were recorded as having been used for the purpose of esophageal protection during left atrial catheter ablations. A total of 5 events associated with the device were identified, all from the MAUDE database. Three were from 2017, one from 2018, and one from 2019. All involved its use in critical care or trauma patients and were related to user error or contraindicated patient selection; none resulted in serious harm to the patient. No adverse events occurred related to its use during left atrial catheter ablations. No case of clinically significant esophageal injury was reported in a patient who had been protected by the esophageal temperature control device.
Conclusion: Real world registry data has shown no adverse events reported to date in 7120 uses of an esophageal temperature control device during left atrial catheter ablations, for the purpose of active thermal protection.

CA-528-04

ANTERIOR WALL TEMPERATURE OF ESOPHAGUS DURING CATHETER ABLATION OF THE LA POSTERIOR WALL IS MARKEDLY HIGHER COMPARED TO LUMINAL TEMPERATURE

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Background: Esophageal injuries (ulceration, denuding of tissue or fistula development) are well-known complications from catheter ablation. Few studies have evaluated energy transfer between the posterior wall of the left atrium (LA), interstitium and esophagus.
Objective: To study energy transfer and lag time between tissues, we developed a porcine *ex vivo* heart-esophageal model to evaluate temperatures at critical regions during catheter ablation of the posterior LA wall.
Methods: We built a heart-esophageal model to perform *ex vivo* catheter ablation on the posterior wall of the LA, with juxtaposed interstitial tissue and esophagus. Circulating saline (3.5-5 L/min) was used to mimic blood flow along the LA and alteration of ionic content to vary impedance. Thermistors along the region of interest were used to analyze temperature gradients. Varying time and power, multiple RF ablations were applied with an externally irrigated ablation catheter. Ablation strategies were divided into standard approaches (SA, 25-35W, 30s) or high-power short duration (HSPD, 40-50W, 10s).
Results: At contact forces ranging from 10-15g, for both SA and HSPD, maximum temperature rise from baseline was markedly higher at the anterior wall (AW) of the esophagus compared to the esophageal lumen (SA: 3.47°C vs. 0.98°C; HPSD: 2.51°C vs. 0.31°C). Compared to HPSD (Figure), SA approaches exhibited significantly higher temperature rise (relative to baseline) at both the AW (3.47°C vs. 2.51°C, $p<0.01$) and within the esophageal lumen (0.98°C vs. 0.31°C, $p<0.02$). For SA, time from ablation onset to a 1°C rise from baseline was 19.2 sec longer in the lumen relative to AW (45.25 sec vs. 26.04 sec, $p<0.05$). For HPSD, time from ablation onset to a 0.5°C rise from baseline was 34.8 sec longer in the esophageal lumen relative to AW (39.10 sec vs. 4.31 sec, $p<0.005$).
Conclusion: Compared to HSPD, SA exhibits significantly higher AW and esophageal lumen temperature rises. From baseline, rise in AW temperature is >2°C compared to the lumen with both approaches. Significant lag time exists between ablation onset and temperature rise measured at the AW and