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 ± 0.8 Hz vs 11.0 ± 0.7 Hz; LAFW: 9.7 ± 0.8 Hz vs 10.4 ± 0.7 Hz; LAA: 8.8 ± 0.5 Hz vs 9.9 ± 0.5 Hz; two-way ANOVA p < 0.001), less fractionated (longer fractionation interval; PLA: 80.4 ± 6.1 ms vs 68.1 ± 5.2 ms; LAFW: 79.3 ± 9.3 ms vs 70.9 ± 3.1 ms; LAA: 87.9 ± 7.8 ms vs 80.3 ± 2.0 ms; 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 ± 1.1, 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.

CA-528-02
SHORT-TERM NATURAL COURSE OF ESOPHAGEAL THERMAL INJURY AFTER RADIOFREQUENCY CATHETER ABLATION FOR ATRIAL FIBRILLATION
Yuki Ishidoya MD; Eugene Kwan; Derek J. Dosdall PhD, FHRs; Leenhapong Navaravong MD, FHRs; Christopher A. Groh MD; Benjamin A. Steinberg MD, MHS, FHRs; T. Jared Bunch MD, FHRs and Ravi Ranjan MD, PhD, FHRs

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: 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).
atresioesophageal 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.

Results: Of the 20,000 esophageal 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
Blair Holman; Christopher Barrett MD; Lukasz Cerbin MD; James Arthur Mann MD; Alexis Z. Tumolo MD; Matthew M. Zipse MD; Lohit Garg MBBS, MD; Johannes C. von Alvensleben MD, CEPS-P; Ryan G. Aleong MD, FHRS; Michael A. Rosenberg MD; Paul D. Varosy MD, FHRS; Wendy S. Tzou MD, FHRS and Amneet Sandhu MD

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. Thermostors 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 (HPSD, 40-50W, 10s).

Results: At contact forces ranging from 10-15g, for both SA and HPSD, 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