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.

**CA-528-04**

**ANTEOR 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 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.

**Objective:** To determine the 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:** 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 critically 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-528-03**

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

Lisa WM. Leung MBChB; Zaki Akhtar; Abhay Bajpai MD; Zia Zuberi PhD; Anthony Li BS, MBBS, MD; Mark Norman; Riyaz A. Kaba MBChB; Manav Sohal MBBS and Mark M. Gallagher MD

**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:** An updated review of the registry of 7120 esophageal temperature control devices by an updated review of real-world registry data on its clinical use and any reported device-related adverse events when used during catheter ablations was conducted. 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 critically 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.
esophageal lumen. With rapidly evolving ablation technologies, these data support further study to reduce inadvertent injury to juxtaposed tissue, improve safety, and enhance efficiency.

Abstracts

CE-520-02

ELECTRO-ANATOMIC REPOLARIZATION MAPPING WITH ORTHOGONAL BIOPOLES AND MULTI-ELECTRODE ARRAYS: THE NEXT FRONTIER IN CATHETER TECHNOLOGY

Stephane Masse MASC, PE; Ahmed Niri BENG; John Asta; Mohammed Ali Azam; Patrick F.H. Lal MSc;
Karl Magtibay BENG, MASC; D. Curtis Deno MD, PhD and Kumaraswamy Nanthakumar MD

Background: Sites of steep repolarization gradients have been attributed to arrhythmogenesis. However, identifying these regions during clinical mapping has not materialized. Activation interval recovery (ARI), monophasic action potential (MAP) and optical mapping are not practical for clinical usage during ablation procedure. Clinical repolarization mapping has not been practically viable largely due to instrumentation and signal processing challenges. We developed here a repolarization mapping technology from orthogonal bipolar derived vector loops and the time projection of the repolarization loop electrogram (loop derived repolarization-optimized egm, (rEGM), for assessment of repolarization on mapping arrays.

Objective: We hypothesised that rEGM provides vector derived integrated action potential duration (APD⁹) that correlates with local repolarization assessed by optical mapping

Methods: Simultaneous optical mapping and epicardial mapping with Abbott Advisor™ HD Grid was performed in 4 rabbit Langendorff experiments. Unipolar eegms from 4 electrodes forming a square in the middle of the grid were recorded and intra-cardiac vectorcardiogram loops computed from orthogonal derived bipolar eegms. rEGM was obtained by projecting the repolarization loop along its maximum axis. Epicardial waves propagating in different direction and pinacidil was added to alter APD. APD⁹ was measured from the onset of QRS to baseline return of rEGM. rEGM derived APD⁹ were compared with fluorescence signals and optical APD90 measured in the middle of the electrode clique.

Results: A total of 61 pairs of APD⁹ measurements were performed. Baseline conditions showed an VAPD average of 142ms versus APD90 of 151ms. After 20uM addition of pinacidil ARI and APD were reduced to 68ms and 89ms respectively. Linear correlation between APD⁹ and APD90 showed a $R^2$ of 0.7134 and a slope of 0.9540.

Conclusion: These results suggests that multi-electrode arrays with orthogonal bipolar could provide intra-electrode cardiac vector loops that enable local APD measurements for mapping utility. This concept ushers an era of using multi-electrode arrays to perform repolarization mapping and create 3D electro-anatomic repolarization maps to identify regions of steep repolarization gradients.

ABSTRACT CE-520:

Novel Arrhythmia Insights and Mapping Techniques

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

CE-520-01

PULMONARY VEIN MYOCARDIAL SLEEVES ACT AS AMPLIFIER SITES DURING PERSISTENT ATRIAL FIBRILLATION: A HIGH DENSITY PHASE MAPPING STUDY

Ahmed Al-Kaisey MBChB; shu meng;
Ramanathan Parameswaran MBBS; Robert Anderson MBBS;
Joshua Hawson; Troy M. Watts BS, CCDS; David Budgett BENG;
Bruce H. Smail PhD and Jonathan M. Kalman MBBS, PhD, FHRS

Background: The mechanisms underlying persistent AF (PeAF) remain poorly defined. Although the substrate is not limited to the pulmonary veins (PVs), recent studies on excised echo chambers (PV antrum) demonstrated Reentry exit from the PV sleeve) was remarkably consistent between patients (125±46ms, range 30-260 ms, n=282). Higher outgoing frequencies were associated with repeated cycles of reentry (1 incoming wave generating 2 or more reentrant outgoing WF) and elevated phase entropy ($R^2 = 0.94$ and 0.93, respectively, $p<0.001$). The median ratio of incoming to outgoing PV activity was 1.14 (LQ=0.84, UQ=1.88). In 6/11 PVs (55%) the R was >1 (Mean 1.77±0.54, maximum 2.68).

Conclusion: Electrical activity generated by PV sleeves during PeAF is due mainly to macroscopic reentry initiated by incoming waves, frequently with a ratio>1. That is, the PVs act less as AF drivers than as “echo chambers” which sustain and amplify fibrillatory activity.

Abstracts

CE-520-02

ELECTRO-ANATOMIC REPOLARIZATION MAPPING WITH ORTHOGONAL BIOPOLES AND MULTI-ELECTRODE ARRAYS: THE NEXT FRONTIER IN CATHETER TECHNOLOGY

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Background: Sites of steep repolarization gradients have been attributed to arrhythmogenesis. However, identifying these regions during clinical mapping has not materialized. Activation interval recovery (ARI), monophasic action potential (MAP) and optical mapping are not practical for clinical usage during ablation procedure. Clinical repolarization mapping has not been practically viable largely due to instrumentation and signal processing challenges. We developed here a repolarization mapping technology from orthogonal bipolar derived vector loops and the time projection of the repolarization loop electrogram (loop derived repolarization-optimized egm, (rEGM), for assessment of repolarization on mapping arrays.

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Methods: Simultaneous optical mapping and epicardial mapping with Abbott Advisor™ HD Grid was performed in 4 rabbit Langendorff experiments. Unipolar eegms from 4 electrodes forming a square in the middle of the grid were recorded and intra-cardiac vectorcardiogram loops computed from orthogonal derived bipolar eegms. rEGM was obtained by projecting the repolarization loop along its maximum axis. Epicardial waves propagating in different direction and pinacidil was added to alter APD. APD⁹ was measured from the onset of QRS to baseline return of rEGM. rEGM derived APD⁹ were compared with fluorescence signals and optical APD90 measured in the middle of the electrode clique.

Results: A total of 61 pairs of APD⁹ measurements were performed. Baseline conditions showed an VAPD average of 142ms versus APD90 of 151ms. After 20uM addition of pinacidil ARI and APD were reduced to 68ms and 89ms respectively. Linear correlation between APD⁹ and APD90 showed a $R^2$ of 0.7134 and a slope of 0.9540.

Conclusion: These results suggests that multi-electrode arrays with orthogonal bipolar could provide intra-electrode cardiac vector loops that enable local APD measurements for mapping utility. This concept ushers an era of using multi-electrode arrays to perform repolarization mapping and create 3D electro-anatomic repolarization maps to identify regions of steep repolarization gradients.