PO-622-03

REDUCING DIVERSE TYPES OF NOISE IN ELECTROPHYSIOLOGICAL SIGNALS USING MACHINE LEARNED AUTOENCODERS

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Background: Reducing signal noise from alternating current, cross-talk from other chambers and pacing is difficult. Encoder-decoders could in theory be trained to learn key signal features and hence separate various types of artifact without experts labeling “signal” or “noise”.

Objective: We hypothesized that machine learned autoencoders could learn essential features of atrial and ventricular electrogams, to identify and eliminate various types of noise. We examined monophasic action potentials in patients, selected because they have verifiable shapes.

Methods: We used 5706 ventricular MAPs in 42 patients with ischemic cardiomyopathy (age 65 ± 13y; fig. A), and 3000 atrial MAPs in 21 AF patients (67 ± 5y, 13 women). We trained ML encoders to each signal type, and determined how well each could eliminate noise from original signals.

Results: The trained ML encoder learned key features of atrial and ventricular signals, and reconstructed them with similarity coefficient 0.91 ± 0.16 and Pearson correlation = 0.99 ± 0.01 (p < 0.01). The trained ML encoder automatically eliminated, without manual input, Fig (A) pacing artifact; (B) ventricular artifact in atrial signals; (C) high frequency noise; (D) signal truncation in ventricular and atrial MAPs.

Conclusion: Machine learned encoder-decoders can eliminate various types of noise from electrophysiological signals by learning essential features of atrial and ventricular signals. This approach may have diverse applications in mapping and ablation targeting.

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SUBSTRATE CHARACTERIZATION AND LONG TERM OUTCOMES OF ZERO FLUOROSCOPY CATHETER ABLATION IN PREGNANT WOMEN

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Background: Although arrhythmias are common in pregnant women, there are few data on efficacy, safety and outcomes of zero-fluoroscopy catheter ablation in this population.

Objective: To evaluate the substrate distribution and the acute and mid-long-term outcomes of pregnant women undergoing arrhythmia ablation without fluoroscopy.

Methods: This is a prospective, single center study enrolling pregnant women with arrhythmias undergoing zero-fluoroscopy catheter ablation. Primary endpoints were substrate ablation and 30-day safety. Secondary endpoints included perinatal and neonatal outcomes evaluated during 18 months follow-up.

Results: A total of 46 pregnant women underwent catheter ablation. Mean age was 26.34 ± 5.73 years, mean gestation age 22.04 ± 4.17 weeks. Ablation was performed under the guidance of CARTO (n = 20; 43.5%) and Ensite Precision systems (n = 26; 56.5%) without fluoroscopy. All 46 cases of ablation were successful. Slow conduction way was the most common type of arrhythmia substrate (n = 21, 45.7%). There were 14 (30.4%) ablation of accessory pathways - in left free wall (n = 8), in right free wall (n = 5), posteroseptal (n = 1). Combination of accessory pathways with slow conduction ways was present in 3 cases (6.5%). Ablation of the right ventricular outflow tract was performed in 8 cases (17.4%) of ventricular tachycardia. The median procedural time was 72 minutes (interquartile range 53-92). In 1 case (2.2%) was documented complication (ileofemoral thrombosis). Perinatal outcomes: vaginal delivery were in the majority of cases (n = 39; 88.6%). None of pregnant women had fetal mortality. Fetal birth weight was 3267.1 ± 608.2 grams. 5 minute Apgar was 8.94 ± 1.7. Arrhythmia recurrence was not documented.

Conclusion: Pregnant women mostly underwent ablation for atrioventricular nodal reentrant tachycardia. Catheter ablation can be performed safely and effectively during gestation without the use of radiation.

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USE OF LOCAL ACTIVATION TIME HISTOGRAM ALGORITHM FOR DETERMINATION OF ARRHYTHMIA MECHANISM AND TO GUIDE ABLATION STRATEGY

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Background: Differentiating focal from re-entrant arrhythmias is critical to ablation success. Activation mapping is often used to guide this determination, but accurate local activation time (LAT) annotation can be challenging, particularly in areas of abnormal voltage. The LAT histogram algorithm, which depicts point distribution over isochronal segments, may be helpful in characterizing arrhythmia mechanisms and identifying an optimal ablation strategy.

Objective: To assess differences in LAT histogram morphology in focal versus re-entrant atrial arrhythmias and correlate ablation strategy guided by LAT histogram with ablation results.

Methods: We retrospectively evaluated cases of atrial tachycardia (AT) in which the LAT histogram algorithm was applied. ATs were characterized as focal or re-entrant by entrainment or activation mapping using CARTO 3 v7 (Biosense Webster; Irvine, CA). LAT histogram morphologies were examined and histogram-guided ablation targets were compared against actual AT ablation sites.