Novel Observations on Intracardiac Electrograms Recorded During Ventricular Fibrillation

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Background: Ventricular fibrillation (VF), is a potentially lethal cardiac arrhythmia, and the number one cause of death in the United States. This condition is traditionally characterized by rapid, erratic electrical impulses in the heart, cutting off blood supply to the vital organs and quickly resulting in death. Currently, there is no cure for VF, and although the triggers for initiating VF have been well investigated, the cardiac substrate responsible for the maintenance of this arrhythmia remains elusive. We hypothesized that the assessment of site-specific differences during VF using electrical mapping in a canine model could provide insight for the determination of the substrate sustaining VF. Methods: We received data recorded during a previous experiment completed by electrophysiologists, and which was stored on a Prucka Cardiolab system. We accessed and performed an extensive analysis of these data to test our hypothesis at a later time. We measured the amplitude, cycle length, and slew rate of these electrical signals at various sites throughout the heart to assess for periodicity. Comparisons were made between the endocardial and epicardial layers of the heart. Results: Three major findings were determined: first, that the model with electrode-tipped catheter mapping was feasible for the investigation of VF; second, that a transmural gradient could be detected between the epicardial and the endocardial layers of the heart ($p=0.00009$); and third, that an additional intramural gradient was found between the distal and proximal conduction systems ($p=0.03$). Conclusion: Our data confirmed a major transmural gradient of activation in VF and uncovered a novel finding suggestive of culprit distal conduction system arrythmogenicity.