

## **Automatic Surface ECG-Based Analysis of Atrial Electrical Activity / Refractoriness – The Rodent Model**

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**BACKGROUND:** The inability to detect atrial electrical activity limits the progression in tachycardia research and clinical applications in animal models and human. In the recent years rodents, including genetically altered mice, have become invaluable tools for studying cardiac arrhythmias. However, studies of atrial electrophysiology (EP) are challenging and EP parameters are hard to determine in rodents. Recently, our group published a first technique to consistently obtain atrial EP parameters of rodents. However, it necessitates equipment and skills that are not generally available. In the present study, using our experimental data as gold standard, we designed an algorithm to detect atrial electrical activity and refractoriness of rodents based on the surface ECG signal.

**METHODS AND RESULTS:** We analyzed ECG signals from 9 rats containing an average of 28 S1-S2 testing protocols with varying S1-S2 intervals. Out of 250 S1-S2 tests, S2 induced atrial activity existed in 167 and failed in 83 cases. The existence of atrial activity correlated well with the interval between the QRS complex triggered by the last S1 and the next QRS complex ( $RR_{S2}$ ). Comparing  $RR_{S2}$  to the spontaneous RR interval ( $RR'$ ) we found three decision-relevant ranges that correlate with the electrophysiology:  $RR_{S2} < 1.02RR'$  indicated existing atrial activity followed by AV conduction.  $RR_{S2} > 1.1RR'$  indicated existing atrial activity followed failure of AV conduction.  $RR_{S2}$  between these values indicated failure of the atrial activity. This algorithm reached very accurate detection results (sensitivity of 94.2%, specificity of 98.7%).

**CONCLUSION:** Detection of rodent atrial electrical activity and refractoriness is feasible based on a simple ECG based algorithm. This tool should advance the ability to gain data on the AERP of rodents using a rather simple experimental setting. This algorithm may be applied in human research and clinical use.