# Changes in RR Series Characteristics during Atrial Fibrillation: An AV Node Simulation Study

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**Aims:** During atrial fibrillation (AF), the atrioventricular node (AVN) modulates the high rate of uncoordinated impulses from the atria to the ventricles. For AF management, rate control drugs can modify the AVN conduction with the aim of reducing the heart rate, determined from the RR intervals of the ECG. Here we investigate the relationship between AVN model parameters and different RR series characteristics during rate control using a network AVN model, and compare results to clinical findings.

**Methods:** The dual-pathway physiology of the AVN was modelled with a series of interacting nodes. Each node computed refractory time and conduction delay individually with model parameters shared across each pathway. The atrial impulse sequence entering the AVN was modelled as a Poisson process with mean arrival rate $\lambda$. The resulting RR interval sequence characteristics were assessed for 16000 randomly selected parameter sets within reported physiological ranges during baseline and beta blocker treatment. Linear regression analysis was performed to investigate the relationship between the model parameters and the resulting heart rate, RR variability quantified using RR rmssd and RR irregularity quantified using RR sample entropy.

**Results:** The resulting regression coefficients show that increasing values of $R^S_{min}$ and $\Delta R^S$, defining the refractory period of the slow pathway, largely contributed to the decreased heart rates. Further, decreased $\lambda$ and increased $R^F_{min}$ and $\Delta R^F$, defining the refractory period of the fast pathway, largely contributed to increased RR variability. The parameters defining conduction delay mainly contributed to RR irregularity.

**Conclusion:** We demonstrate that the model can replicate the changes in RR interval series characteristics associated to beta blocker treatment, namely decreased heart rate, increased RR variability and increased RR irregularity.

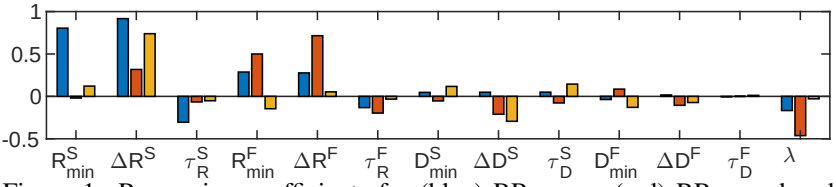


Figure 1: Regression coefficients for (blue) RR mean, (red) RR rmssd and (yellow) RR sample entropy for each model parameter