

The Shift Function for Heart Rate Variability Comparison

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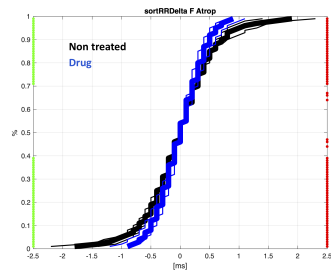
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We recently developed the analysis of heart rate dynamics in mice using a modified shift function (SF) approach. The current work details how sorting RR intervals enables the comparison of female or male mice, without (baseline) and with pharmacological autonomic blockades (atropine, propranolol, and combined autonomic block CAB). The SF results are evaluated alongside conventional heart rate variability parameters (mean RR, SDRR, RMSSD).

Female and male C57Bl/6 mice (n=19 for each sex) were placed in a tunnel device for ECG acquisition during 10 minutes for each experiment. Classical parameters and SF with Benjamini–Hochberg (1), Max-T (2) and cluster-based permutation (3) for Type-I error corrections were applied. Using the SF approach, raw RR interval distributions (SortRR), median-centered RR intervals (sortRRdev), and consecutive RR differences (sortRRDelta) were analyzed. After propranolol treatment, all six measures revealed clear differences from baseline in both sexes.

Under atropine, sortRRdev, sortRRDelta and SDRR detected significant differences from baseline for both sexes (see figure). For CAB, similarly to mean RR, sortRR showed significant differences in both sexes, while only sortRRDelta distinguished the two groups for short and long interval differences.

This study demonstrates that the shift function approach provides a more sensitive and comprehensive characterization of autonomic modulation of heart rate than conventional parameters. By analyzing the full RR interval distribution, SF measures reveal drug- and sex-dependent effects that remain undetected by standard metrics. These results highlight the added value of distribution-based approaches for studying cardiac autonomic regulation.



Comparison of sortRRDelta for female mice. Red dots: (1) OR (2) true. Green dots: (3) true.