

# **Time-Frequency Analysis of Heart Rate Variability in Neonatal Piglets Exposed to Hypoxia**

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A large inter-individual variation has been observed in the cardiovascular response to hypoxia in newborns. To determine whether the autonomic nervous system (ANS) plays any role in this variation, heart rate variability (HRV) analysis was used to assess the ANS response to hypoxia in ventilated newborn piglets. Due to the nonstationary nature of HRV signals and the inaccuracy of the widely used pre-defined neonatal HRV frequency bands, we utilized time-frequency distribution (TFD) to analyze piglet HRV. The most important information in the TFD of the HRV is contained in the instantaneous frequency (IF) and instantaneous power (IP) of the time-frequency components. We estimated the IF and IP by an image processing technique comprising thresholding and component linking. In the six newborn piglets exposed to hypoxia, the low frequency (LF) component of HRV was located between 0.03-0.04 Hz and showed no significant difference from that before hypoxia ( $p=0.0951$ ). The power of the LF component, reflecting sympathetic activity under hypoxic condition, increased during the first 5 minutes of hypoxia and then dropped to baseline levels rapidly. There was no association between LF power and heart rate responses to hypoxia among the animals. These results suggest that the sympathetic nervous system contributes to the initial cardiovascular response to hypoxia but is unable to sustain this contribution. This is potentially attributed to the immaturity of the neural pathway.