

Heart Rate Variability Using Poincaré Plots in 10 Year Old Healthy and Intrauterine Growth Restricted Children with Reference to Maternal Smoking Habits During Pregnancy

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The diagnosis of intrauterine growth restriction (IUGR) is given to children considered small for their gestational age. IUGR is associated with diseases later in adulthood, including hypertension, diabetes and stroke. ECG data taken from a cohort of 73 children at 10 years of age, using a Holter monitor, was analysed to investigate the heart rate variability during sleep. The cohort was split into 4 groups depending on the maternal smoking during pregnancy habits as well as IUGR or normal birthweight status. Beat to beat RR-interval analysis preceded the production of Lomb periodograms. Following this, Poincaré plots were created. The actual sleeping hours were decided from analysis of RR-intervals and the power of spectra in the high frequency region (indicating respiratory sinus arrhythmia) on the Lomb periodograms. This analysis enabled low frequency to high frequency (LF/HF) ratios to be found during waking and sleeping hours. During waking, the LF/HF ratio showed that IUGR children whose mothers did or did not smoke parent during pregnancy have elevated levels (2.67, 2.90) respectively, compared to the normal groups (2.23, 2.19) during waking. During sleep the LF/HF ratio was (0.70, 0.80) for IUGR, and (0.52, 0.53) for normal children. Among children whose mothers smoked during pregnancy, the Poincaré plot analysis of long-term variability during sleep found less long term HRV in IUGR ($SD2=148.53ms$) than in healthy children ($SD2=182.87ms$, $p=0.02$). Poincaré plot testing suggested that asthmatic children were consistently returning different results compared to the other children in their groupings. Following this, a Poincaré plot analysis was employed from which significantly lower short-term variability was found for IUGR asthmatic children whose mothers smoked. It is suggested that smoking during pregnancy can have adverse implications for the development of autonomic nervous system of the IUGR child.