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心血管变异性的中枢调节数学模型

吴国强、赵耐青、沈霖霖、汤大侃
复旦大学基础医学院

通过建立心血管变异性的数学模型,讨论心血管中枢对心血管调节的作用。由血流动力学公式、心交感和心迷走对心率的控制、压力感受器反射以及心血管中枢的活动性构成闭环的拍-拍心血管变异性数学模型。获得如下结果:模型仿真了,1)心血管变异性的三个主要的频率成分;2)传出神经活动也具有与心血管变异性相同的频谱特性;3)压力反射的S形曲线及其受心血管中枢的影响;4)心血管变异性的昼夜节律现象。本模型成功地仿真了心血管变异性的主要特征,尤其提示了心血管中枢的活动对心血管变异性和压力反射敏感性有极大的影响。

A MODEL OF CENTRAL REGULATION IN CARDIOVASCULAR VARIABILITY

A mathematical model of cardiovascular variability was developed to evaluate the influence of central regulation on cardiovascular variability in this paper. The model includes 1) the simplest hemodynamic formula, 2) the regulation of heart rate by sympathetic and parasympathetic efferents, 3) baroreceptor reflex, and 4) the central cardiovascular activity influenced by baroreflex and relayed signals from higher level of central nervous system. The simulation of the model showed as follows: 1) the three main spectral components of cardiovascular variability which are coincident with clinical measurement, 2) the same spectral peaks existed in the spectra of both sympathetic and parasympathetic efferents, 3) the sigmoid curve of baroreceptor reflex and its relationship with central nervous activity, and 4) the circadian of cardiovascular variability. The model simulated the main characteristic of cardiovascular variability successfully. The results indicate that the central nervous activity plays an important role in the regulation of cardiovascular variability.

关键词

心血管变异性(Cardiovascular variability); 数学模型(Mathematical model); 心血管中枢 (Cardiovascular center)