疾病狀態及身體活動度對第 1 型糖尿病兒童心率變異度之影響

Impact of Disease Status and Physical Acitivity on Heart Rate Variability in Children with Type 1 Diabetes

中文摘要

自主神經病變與糖尿病心血管疾病的發生率及死亡率有著密切的關係，而肥胖是第 2 型糖尿病的高危險群，心率變異度(heart rate variability, HRV)的下降反映出自主神經的不平衡，並且是許多疾病死亡率的重要預測因子。往昔研究著重在比較第 1 型糖尿病與健康個案心率變異度的差異，並將這種差異歸因於高血糖的結果，對於其它影響因子的研究較少。本研究目的爲：一、探討血糖控制及罹病年數對第 1 型糖尿病兒童心率變異度之影響。二、探討身體活動度對第 1 型糖尿病及健康兒童心率變異度之影響。三、探討身體活動度對肥胖及健康兒童心率變異度之影響。

本研究爲一橫斷性研究，採立意取樣，研究對象包括診斷第 1 型糖尿病的兒童、肥胖兒童及同年齡、性別的健康兒童，共收取 93 位爲第 1 型糖尿病兒童，88 位肥胖兒童以及 107 位健康兒童。研究工具以心電圖測量個案在休息狀態及活動狀態下的心率變異度，並以「身體活動量表-兒童版」調查個案每週平均身體活動量。

研究結果顯示，第 1 型糖尿病兒童的 LnLF、LnHF 及 LnTP 顯著低於健康兒童，相較於罹病年數，糖化血色素對 LnLF、LnHF 及 LnTP 具有較高的解釋力。第 1 型糖尿病兒童，若同時出現血糖控制不良加上罹病年數長，則其心率變異度會顯著的降低。肥胖兒童之 LnHF 及 LnTP 顯著低於健康兒童，LnLF 雖略高於健康兒童，但無顯著差異。而肥胖兒童除 LnLF 顯著高於第 1 型糖尿病兒童外，LnHF, LnLF/LnHF 及 LnTP 與第 1 型糖尿病兒童並無顯著差異。當由休息狀態轉變爲活動狀態，無論第 1 型糖尿病、肥胖或健康兒童均呈現心率變異度顯著的下降，且活動狀態下心率變異度的表現和休息狀態是不一樣的。在身體活動度部分，輕度身體活動之第 1 型糖尿病兒童，其 LnLF、LnHF 及 LnTP 均顯著低於中、重度身體活動之第 1 型糖尿病兒童及健康兒童。而輕度身體活動之肥胖兒童，其 LnHF 及 LnTP 顯著低於健康兒童，但中、重度身體活動之肥胖兒童，LnHF 及 LnTP 傾向與健康兒童無差異。

本研究依上述結果做出以下結論：一、良好的血糖控制，可以預防或延緩第 1 型糖尿病兒童心率變異度的下降。二、第 1 型糖尿病及肥胖兒童心率變異度均顯著低於健康兒童，且主要以副交感神經功能的下降爲主。三、中度以上身體活動度之第 1 型糖尿病及肥胖兒童，其心率變異度顯著高於輕度身體活動度之第 1 型糖尿病及肥胖兒童。

英文摘要

Autonomic neuropathy is one of the major complications of diabetes, and is associated with morbidity and mortality of diabetes. Obesity is a high risk factor of type 2 diabetes. Heart rate variability (HRV) has been used to assess the dysfunction of autonomic nervous system. Reduced HRV reflects autonomic imbalance and has been shown to be an independent predictor of mortality in various patient population. Most of the studies focused on the differences of HRV between type 1 diabetic and healthy children, and attributed the autonomic neuropathy of diabetes to the effects of hyperglycemia. However, the influences of other factors on the autonomic nervous function in diabetic children are little known. The purpose of the research is to explore the impact of disease status on HRV in type 1 diabetes, and to explore the influence of physical activity on HRV in type 1 diabetes and healthy children. The influences of physical activity on HRV in obese and healthy children were also studied.

This is a cross-sectional study using purposive sampling which includes type 1 diabetic children, obese children, and healthy control children. A total of 93 type 1 diabetic children, 88 obese children, and 107 healthy children were recruited. Electrocardiography was used to measure HRV both in resting state and active state. Physical activity questionnaire for children was adopted to explore their average physical activity.

The results showed that: type 1 diabetic children had significant lower LnLF, LnHF, and LnTP than those of healthy children. Glycosylated hemoglobin and disease duration are two factors that affecting HRV in type 1 diabetes. Only children with poor glycemic control and extended disease duration will manifest autonomic neuropathy. Obese children had significant lower LnHF and LnTP, but similar LnLF, LnLF/HF than those of healthy children. When proceeding from resting state to active state, there was consistent decrease of LnLF, LnHF, and LnTP for all the study groups. However, the response of HRV during exercise differed from the responses of HRV at rest. Diabetic children with low physical activity have a HRV significantly lower than healthy control. However, the HRV among patients with moderate activity, high activity, and the healthy control were not different. The increase of physical activity was associated with an improvement of autonomic nervous function in obese children.

We concluded that hypoglycemic control may help prevent the decrease of HRV in type 1 diabetes. Type 1 diabetes and obese children had significant lower HRV than those of healthy children. The increase of physical activity was associated with an improved HRV in type 1 diabetes and obese children, especially activity with moderate intensity.