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The role of cardiac high energy phosphate metabolism in cardiac function and performance: The impact of age

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Background: Cardiac dysfunction and diminished performance are major characteristics of heart failure. Diminished cardiac energy phosphate metabolism (i.e. PCr/ATP) has been suggested to cause cardiac dysfunction and chronic heart failure. The aim of this study was to define the relationship between cardiac high-energy phosphate metabolism and cardiac performance.

Methods: Thirty-six healthy women (younger, ≤50 years, n=20; and older ≥60 years, n=15) underwent cardiac MRI with 31P spectroscopy to assess cardiac high-energy phosphate metabolism (i.e. PCr/ATP ratio), and performed cardiopulmonary exercise testing with non-invasive central hemodynamic assessment. Cardiac power output (CPO), as a measure of cardiac performance, was calculated as the product of cardiac output and mean arterial blood pressure.

Results: PCr/ATP ratio was significantly lower in older compared to younger age women (1.92±0.48 vs. 2.29±0.55, $p<0.05$), as were peak exercise CPO (3.35±0.73 vs. 4.14±0.81 watts, $p<0.01$), diastolic function (i.e. E/A ratio, (1.33±0.54 vs. 3.07±1.84, $p<0.01$), and peak exercise oxygen consumption (1382.9±255.0 vs. 1940.3±434.4 ml/min, $p<0.01$). Further analysis revealed that PCr/ATP ratio shows significant positive relationship with E/A ratio ($r=0.42$, $P<0.05$), peak CPO ($r=0.40$, $p<0.05$), and peak oxygen consumption ($r=0.50$, $p<0.01$). Subgroup analysis based on age however showed that PCr/ATP ratio was significantly related to peak CPO in younger but not in older women ($r=0.44$, $p=0.05$ vs. $r=0.14$, $p>0.05$).

Conclusions: High-energy phosphate metabolism and performance of the heart decline with age. Our findings demonstrate that cardiac high-energy phosphate metabolism plays an important role in overall cardiac function and performance in younger but not older age.

Biography

Maria Nathania is an intercalating medical student from Universitas Indonesia, currently undertaking her Post-graduate (MRes, Master by Research) degree in Cardiovascular Sciences at Newcastle University (UK). In 2015, she presented her work on the International Student Congress of Medical Sciences held by the University Medical Center Groningen. She has profound interest in Cardiology and participated in a short research fellowship with Prof. Adriaan A. Voors, MD, PhD, looking at the effect of Aliskiren on urine albumin to creatinine ratio in patients with chronic heart failure and renal dysfunction.

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