Continuous beat to beat monitoring the cardiovascular parameters in response to autonomic stress tests

Hind Alzahrani, Ian Macdonald and Peter Mansell
Nottingham University, UK

Study Objective: The aim of this study was to develop a method of assessing cardiovascular function (heart rate (HR), cardiac output (CO), blood pressure (BP)) in response to deep breathing, standing maneuver and handgrip exercise, using a Finometer.

Subjects: Twenty subjects (10 males and 10 females) were healthy, young mean age 24.4 years males and 26.7 years females, non-obese mean ± SD of BMI was 23.4±7.4, 22.8±4.5 males and females respectively.

Methods: Beat to beat heat rate and blood pressure variability were monitored during deep breathing test, posture change to standing position and handgrip exercise using a Finometer. This involves a finger cuff pressure which placed in the middle left finger and arm cuff pressure on the upper left arm. Then, automatic calibration was made followed by recording of baseline measurements for 3 minutes and then physiological maneuvers were performed starting with deep breathing (2 minutes), standing (2 minutes) and handgrip exercise at 20%, 40% of MVC (2min) and 60% of MVC (1 minute). This event separated by time for recovery (15min) as well as (3min) baseline measurements before each physiological maneuver.

Results: A significant increased and decreased in cardiovascular parameter during inspiration and expiration in both gender respectively (p<0.05). Orthostatic maneuver caused a significant reduction in systolic blood pressure and cardiac output whereas HR (p<0.05) and DBP (P>0.05) increased in both genders. Cardiovascular parameters showed a significant increased during handgrip exercise at 40% and 60% of MVC but not during 20% of MVC.

Discussion: Cardiovascular changes during inspiration and expiration caused a stimulation or inhibition of pulmonary stretch receptors respectively; this was companied with changes of abdominal and intra-thoracic pressures. This was confirmed in the study, a significant reduction (P≤0.05) of the parameters during inspiration and increased (P≤0.05) during expiration which completely driven by parasympathetic nervous system. Posture maneuver causes blood pooling to the lower part of the body lead to decrease of cardiac output and venous return which stimulated the sympathetic and inhibited parasympathetic nervous system which in turn causes an increases of heart rate to maintain a reduction of blood pressure. A significant increase of cardiovascular parameters (P≤0.05) during handgrip exercise at 40% and 60% of MVC and this was due to stimulation of sympathetic discharge and inhibition of vagal tone as well as peripheral reflexes which originated from exercising muscle. Gender differences in responses to autonomic stress tests might be related to several factors such as body size, muscle mass and sex hormone. Overall, a variability of cardiovascular parameters during physiological maneuvers reflected the integrity and effectiveness of neuro-cardiovascular control. This will apply on the patients suffering from diabetic neuropathy and therefore developed a method to evaluate the autonomic nervous disorders.

Biography
Alzahrani completed MSc in integrated physiology in health and diseases at Nottingham University in 2013. Then, she stared PhD in 2014 in the physiology (Beat to beat Cardiovascular monitoring using Finometer/concentration in cardiovascular response to autonomic stress testes) at Nottingham University. Alzahrani interested in developing a method to evaluate the autonomic disorders such as Diabetic Neuropathy.

mbxha8@nottingham.ac.uk

Notes: