76° Congresso Annuale SIC -
Roma, 11 – 14 dicembre 2015

ARITMIE
FIBRILLAZIONE ATRIALE (FA) (ARITMIE/STIMOLAZIONE/RISINCRONIZZAZIONE)
ATTIVITA' FISICA (ATTIVITA' FISICA E CARDIOLOGIA DELLO SPORT)
FISIOLOGIA INTEGRATIVA E MECCANISMI DI CONTROLLO (SCIENZA DI BASE)

HIGHER RESTING HEART RATE RELATES TO GREATER RISE IN PULMONARY VEIN PRESSURE UNDER EXERCISE DURING PERMANENT ATRIAL FIBRILLATION: A COMPUTATIONAL STUDY

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Background: Clinical data indicating a heart rate (HR) target during rate control therapy for permanent atrial fibrillation (AF) and regarding its eventual relationship with reduced exercise tolerance are lacking.
Objective: The present study aims at investigating the impact of resting HR on cardiovascular response to exercise in permanent AF patients by a computational cardiovascular model.
Methods: The AF lumped-parameter model was run to simulate resting (1 Metabolic Equivalent of Task - MET) and various exercise conditions (4 METs: brisk walking; 6 METs: skiing; 8 METs: running) starting from different resting HR (70 bpm for the slower resting HR - SHR - simulations, and 100 bpm for the higher resting HR - HHR - simulations). To allow comparison of relative variations of cardiovascular variables upon exertion, the variation comparative index (VCI) - the absolute variation between the exercise and the resting values in SHR simulations referred to the absolute variation in HHR simulations - was calculated at each exercise grade (VCI_4, VCI_6 and VCI_8).
Results: Pulmonary vein pressure ($VCI_4 = 0.71$, $VCI_6 = 0.73$ and $VCI_8 = 0.77$) underwent a greater increase, while systemic arterial pressure variations ($VCI_4 = 1.15$, $VCI_6 = 1.36$, $VCI_8 = 1.56$) experienced a less sustained increase than expected in HHR compared to SHR simulations.
Conclusions: In terms of exercise tolerance, a slower resting HR could be preferable in permanent AF patients, since pulmonary vein pressure undergoes a slighter increase and systemic blood pressure a more appropriate increase with respect to a higher resting HR.