

Effects of prolonged head-down bed rest on sympathetic baroreflex control and orthostatic tolerance

¹Franca Barbic, ²Karsten Heusser, ¹Dana Shiffer, ¹Maura Minonzo, ⁴Beatrice Cairo, ²Jens Tank, ²Jens Jordan, ³André Diedrich, ^{4,5}Alberto Porta, ⁶David Robertson, ¹Raffaello Furlan.

¹Department of Internal Medicine, Humanitas Clinical and Research Center, Rozzano (MI), Humanitas University, Rozzano, Italy.

²Institute of Aerospace Medicine, German Aerospace Center (DLR), Cologne, Germany

³Autonomic Dysfunction Center, CRC, Vanderbilt University, Nashville, TN

⁴Department of Biomedical Sciences for Health, University of Milan, Italy.

⁵Department of Cardiothoracic, Vascular Anesthesia and Intensive Care, IRCCS Policlinico di San Donato, San Donato Milanese, Italy.

Orthostatic intolerance has been described after prolonged bed confinement in several clinical settings. This may impact patients' quality of life and increase risk of falls. Standing is associated with unloading of baroreceptor activity controlling heart rate (HR) and sympathetic vasomotor discharge assessed by muscle sympathetic nerve activity (MSNA). In the present study we evaluated the changes in baroreceptor response and in orthostatic tolerance induced by controlled long lasting bed rest in healthy volunteers.

As part of the European Space Agency Medium-term Bed Rest protocol, eight volunteers (33 ±1yrs) were studied before and after 21-days of -6° head down bed rest (HDBR).

Subjects underwent ECG, beat-by-beat blood pressure, respiratory activity and MSNA recordings during 15-minutes of 80° head-up tilt (HUT) followed by a 3-minute -10mmHg stepwise increase of lower body negative pressure, up to pre-syncope.

The α index obtained in the low frequency band (0.1 Hz) by cross-spectrum analysis of RR and systolic arterial pressure (SAP) variability quantified the cardiac baroreflex sensitivity. The percentage of MSNA burst occurrence for different diastolic pressure values (grouped in bins of 1 mmHg) was assessed. The slope of the regression line between MSNA bursts % and diastolic pressure was assumed to represent the gain of sympathetic baroreflex control (sBRS).

the subjects orthostatic tolerance was decreased after HDBR (12±0.6min) compared to baseline (21±0.6min).

In the supine position HR, SAP and α index were unchanged before and after HDBR. During HUT, HR and SAP were unmodified, α index was lower after (3.4±0.7) compared to before HDBR (6.4±1.0). While supine, sBRS was lower after (-2.9±1.5 %/mmHg) compared to before HDBR (-6.0±1.1 %/mmHg). Similarly, during HUT sBRS was lower after HDBR (-2.2±0.6 %/mmHg) compared to before (-4.4±0.4%/mmHg). These data suggest that prolonged bed confinement decreased the overall baroreceptor sensitivity. These alterations may be involved in the reduction of orthostatic tolerance.