Effect of lower body negative pressure on orthostatic tolerance and cardiovascular function during 21 days head-down tilt bed rest

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Introduction: Orthostatic intolerance commonly occurs when the astronauts return to Earth or just after landing of the Space Shuttle or the airship cabin. The decreased orthostatic tolerance is thought to represent one of the dangers of space flight. Lower body negative pressure (LBNP) sessions have shown beneficial effects to counter orthostatic intolerance in previous studies. The purpose of the present study was to investigate the changes of orthostatic tolerance and cardiac function during 21 d head-down tilt (HDT) bed rest and effect of LBNP in the first and the last week in humans. **Methods:** Twelve healthy male volunteers were exposed to – 6° HDT bed rest for 21 d. Six subjects received –30 mmHg LBNP sessions for 1h per day from the 1st to the 7th day and from 15th to the 21st day of the HDT, and six others served as control. Orthostatic tolerance was assessed by means of standard tilt test. Stroke volume (SV), cardiac output (CO), preejection period (PEP) and left ventricular ejection time (LVET) were measured before and during HDT. **Results:** Before HDT, all the subjects in the two groups completed the tilt tests. After 10 d and 21 d of HDT, all the subjects of the control group and one subject of the LBNP group could not complete the tilt test due to presyncopal or syncopal symptoms. The mean upright time in the control group (15.0±3.2 min) was significantly shorter than those in the LBNP group (19.7±0.9 min). SV and CO decreased significantly in the control group on days 3 and 10 of HDT, but remained unchanged throughout HDT in the LBNP group. A significant increase in PEP/LVET was observed on days 3 and 14 of HDT in both groups. The PEP/LVET in the LBNP group was significantly lower on day 3 of HDT, while LVET in LBNP group was significantly higher on days 3, 7 and 14 of HDT than those in the control group. **Conclusion:** The results of this study suggest that brief daily LBNP sessions used in the first and the last weeks of 21 d HDT bed rest were effective in diminished the effect of head-down tilt on orthostatic tolerance, and LBNP might partially improve cardiac pumping function and cardiac systole function.