Simulated microgravity elicits an increase in hypobaric and normobaric hypoxic ventilatory response in rats

Poster

Responses to acute or chronic hypoxia

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Background: Microgravity is experienced during orbital flight, and it is well established that after prolonged exposure (upon return to Earth), astronauts develop changes such as osteoporosis, weight loss, muscle mass loss, orthostatic intolerance, and impaired baroreflex control. These alterations are often attributed to blood-flow redistribution; nevertheless, the mechanism is not completely clear. Notably, seminal evidence has suggested that the hypoxic ventilatory response (HVR) increases after long-term microgravity exposure, implying that chemoreceptors could be involved in autonomic impairment.

Objective: To characterize chemoreflex control by assessing hypobaric and normobaric hypoxic ventilatory responses in animals previously subjected to simulated microgravity.

Methods: Adult male Wistar Kyoto rats underwent 2 weeks of simulated microgravity using the head-down pelvic suspension model, which mimics the flow redistribution experienced by astronauts. Animals were assigned to Micro-G (n=6) or Sham (n=4). Before and after the exposure, we assessed hypobaric-hypoxic ventilatory response (HHVR), normobaric hypoxic ventilatory response (NHVR), sensitivity at endpoint,

muscle performance, and VO_2 peak.

Results: After the 2-week microgravity period, the ventilatory chemoreflex was potentiated under both HH and NH, whereas baroreflex sensitivity, VO_2 peak, and muscle performance were markedly decreased. Interestingly, the chemoreflex potentiation significantly correlates with a decrease in baroreflex sensitivity in those animals, suggesting that orthostatic intolerance after spaceflight could be associated with enhanced chemoreflex drive.

Conclusions: The hind-limb suspension microgravity model recapitulates the principal adaptations promoted after prolonged microgravity exposure and reveals chemoreflex potentiation, which could open new research opportunities as well as possible new therapies to treat astronauts following a long-term spaceflight

Palabras Clave

(1) Microgravity, (2) peripheral chemoreflex, (3) exercise, (4) baroreflex, (5) hypoxic ventilatory response.

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