

SPACE LIFE SCIENCES SYMPOSIUM (A1)
Human Physiology in Space (2)

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HYPERTROPHY OF THE NECK MUSCULATURE DUE TO PROLONGED BED-REST?

Abstract

Purpose: Prolonged bed-rest is an established model to simulate the effects of spaceflight on the human body. To date, the lower half of the body has received the most attention in musculoskeletal studies in bed-rest and no data is available on muscles and intervertebral discs of the cervical spine. Based upon the limited existing data we hypothesized that (a) hypertrophy of the neck flexors, (b) atrophy of the postural neck extensors and (c) increases in cervical intervertebral disc size would occur as a consequence of prolonged bed-rest.

Methods: 24 subjects participated in the 60d 2nd Berlin BedRest Study (BBR2-2) and were randomised to an inactive control, resistive exercise only or resistive exercise plus whole-body vibration groups. Before, during and up to 90d after bed-rest axial magnetic resonance imaging scans were performed from the base of the skull to the 3rd thoracic vertebra. On these scans, the volumes of nine major muscle groups were measured. Here we report data from the semispinalis (cervical and thoracic portions; a postural neck extensor), sternocleidomastoid (superficial neck flexor) and levator scapulae (shoulder elevator and neck lateral flexor) muscles. Sagittal scans encompassing the entire cervical spine were performed and the volumes of all cervical intervertebral discs measured.

Results: In the inactive control group, the volumes of the neck flexor sternocleidomastoid (mean[SD] change at end-bed-rest: +4.6[4.2]%; $p=0.002$) and neck extensor semispinalis (+3.9[4.3]%; $p=0.012$) increased significantly during bed-rest. These effects persisted 14d ($p<0.0008$) but not 90d ($p>0.5$) after bed-rest. No significant change in levator scapulae volume was seen (+2.4[8.1]%; $p=0.39$). The remaining six muscles hypertrophied. The countermeasure exercise training performed in bed-rest was associated with greater increases in neck muscle volume than in the control group. This effect only reached significance for the levator scapulae muscle ($p=0.038$). No significant changes in cervical disc volume were seen in any group (all subjects: -0.1[3.1]%, $p=0.86$).

Conclusions: Bed rest is not a model of inactivity for the cervical region and results in muscle hypertrophy. Contrary to findings in other regions of the body, the postural muscles of the neck hypertrophy during bed-rest. Unlike in the lumbar spine, where increases in disc size were seen in the same subjects (Ref.1), the cervical intervertebral discs did not change in size. The effects seen were likely due to continued use of the cervical spine during daily activities, and countermeasure exercise, in prolonged bed-rest.

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