

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

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INCOMPLETE RECOVERY OF THE LUMBAR INTERVERTEBRAL DISCS AFTER 60D AND 21D
STRICT BED REST

Abstract

Purpose: Prolonged bed-rest in otherwise healthy subjects is a unique model to understand the processes involved in adaptation to disuse and re-use the human body. In prolonged bed-rest, increases in disc volume, disc height and spinal length occur. However, the extent of recovery of these changes long-term after prolonged bed-rest is less clear.

Methods: After 60d strict bed-rest, 21 male subjects returned 90-, 180- and 720-days later for follow-up magnetic resonance imaging as part of the 2nd Berlin BedRest Study. In another 21d bed-rest study ("nutrition countermeasures" study in Cologne, Germany), 7 male subjects were scanned 1-, 5- and 154-days after strict bed-rest. In both studies, 29 sagittal plane images captured the entire volume of the lumbar spine using the same scanner settings. Lumbar disc volume, anterior and posterior disc height and intervertebral length were measured.

Results: In the 60d bed-rest study the mean(SD) average lumbar disc volume increased by 5.7(3.1)% at the end of bed-rest ($p < 0.001$). 90d, 180d and 720d after 60d bed-rest, disc volume remained, respectively, 4.3(2.6)% ($p < 0.001$), 3.2(2.0)% ($p < 0.001$), 2.2(1.9)% ($p < 0.001$) above baseline values. In the 21d bed-rest study, L4L5 (+12.2(13.8)%; $p = 0.020$) and L5S1 (+27.9(22.1)%; $p = 0.001$) disc volume remained significantly above baseline values 154d after 21d bed-rest. Similar results were seen in both studies for disc height and intervertebral length measures.

Conclusion: The recovery of the lumbar intervertebral discs after prolonged strict bed-rest is a lengthy process. This process is incomplete within 2 years after 60d bed-rest or 5 months after 21d bed-rest.

Available data from biomechanical and clinical studies suggest such persistent changes could increase the risk of intervertebral disc injury. This potential negative consequence requires study in future work.