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# BACK PAIN IN SIMULATED MICROGRAVITY: A PRELIMINARY STUDY

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## Summary

We studied the appearance of back pain in 10 healthy volunteers aged between 26 and 35 years staying in a normal anti-bed-sore bed for a 5 day period and after a week interval spending another 5 day period in a simulated microgravity condition. Back pain was described by 7 volunteers during the period in condition of simulated microgravity, universally localized to the low back pain. Incidence and intensity of pain were remarkable only in condition of simulated microgravity.

## Introduction

Studies about the anatomic and physiological changes in the human body exposed to microgravity are an interesting new field of research, since they allow a unique opportunity to investigate common medical problems from a new perspective (1,2,3).

Many models have been developed to simulate in the laboratory condition of microgravity and to overcome the difficulties of researching during space flights.

This study was carried out at the University Neurospace Laboratory in Innsbruck in order to investigate an overlooked problem encountered during space flight, namely the appearance of back pain. The studies on this topic are still poor (4,5) and no sure interpretation of the phenomenon has yet been found.

Our aim was to study if back pain also appears in simulated microgravity, to give a contribution to the explanation of the phenomenon.

## Materials and methods

We studied 10 healthy male volunteers aged between 26 and 35 years (mean age 29.4 years), both in bed-rest condition and in simulated microgravity by dry waterbed.

The volunteers stayed in a normal anti-bed-sore bed for a five day period always in a supine position and a week later for another 5 day period in simulated condition of microgravity in a circular pool with a 3.5 meter diameter and one meter depth, resting on the floor and separated by appropriate insulating material. The pool was always full of water which was continuosly changed by a pump and maintained at the constant temperature of 31°C by a thermostat. A 0.5 mm thick plastic sheet was placed above water level. The subjects lay on this plastic sheet separated from it by a cotton sheet.

The volunteers were asked to complete daily a pain diagram (fig. 1), adapted from Ransford and colleagues (6) indicating the incidence, intensity, location, character, duration of pain and factors that made the pain better or worse.

## Results

The results are summarized in table one.

During the five day period in an anti-bed-sore bed only 3 (30%) volunteers described experiencing pain. It was localized to the low back, of very low intensity (2 subjects described it as discomfort, one as negligible) and with dull character. The pain arose universally during the 2nd day of the study and went on ranging in intensity from a minimum in the morning to a maximum in the evening. The three volunteers who experienced pain reported some relief from their pain by forced compression at the low back. Additional symptoms such as a sensation of heaviness over the anterior surface of both thighs were present in one subject.

In simulated microgravity condition 7 of the 10 volunteers experienced back pain, which was almost universally localized in the low back: only 3 subjects who reported low back pain also described pain in the posterior cervical spine (1) or in the mid back (2). It was described as dull pain in 6 subjects, one subject reported burning pain. The intensity of the pain ranged from 2 to 5: in 3 volunteers it remained constant after its arising (on the 1st day in one subject, on the 2nd day in the other 2), with an

intensity of 2 (2 volunteers) or 3 ( one volunteer). In the other 4 volunteers the pain fluctuated in intensity since the 1st day from 2 to 4 (in 2 subjects), from 3 to 5 (1) and from 4 to 5 (1). The maximum of intensity was always on the evening or during the night. The 2 subjects who experienced the maximum pain had a very disrupted sleep on the first night and they assumed daily painkillers, since the 2nd day to relieve the pain (as soon as it was intolerable). All the volunteers described relief from their pain by forced compression on the painful region, 4 also by assuming a fetal tuck position. No additional symptoms were described.

## Discussion

Despite the fact that back pain seems to be a very frequent discomfort observed during space flights, the studies regarding it in microgravity conditions are still poor. We know only a mention of back pain during the Skylab mission (4) and a retrospective study of Wing et al. (5).

In our study we aimed to check if back pain arises in condition of simulated microgravity. We found a very significant incidence of back pain in the 10 volunteers (tab. I) when they stayed in the pool of simulation, while the incidence was very smaller (3 of the 10) and the pain universally slight during the control period in an anti-bed-sore bed. That seems to show the forced supine position is not sufficient to justify the pain. We suppose that the simulated microgravity condition may someway cause dysfunctions in the somatosensory system. As far as regards this the reduction of the sensory input may be especially important.

An interesting hypothesis is that of Wing et al., who attributed back pain in real microgravity to the known height change (4,7,8) during space flight, which may be related to traction on the spinal cord and secondary spinal cord impairment. In the present study we have not analyzed this topic, it will be the subject of a further study.

Another possibility is that simulated microgravity causes muscular changes with the secondary release of neurotransmitters and/or catabolities irritating for the sensitive termination. They could accumulate in the low back region because of the reduced emolymphatic drainage caused by both the muscular inactivity and the forced position that the volunteers assume in the pool.

A further study to verify these hypothesis will be necessary on a sufficient number of volunteers to obtain information which may also have important clinical implications.

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Table 1: Results

| SURVEY AREA | NO (%) OF ALL RESPONDENTS |
|---|---|
| Bed rest condition | Simulated Microgravity |
| Pain intensity* | |
| 0 (no pain) | 7 (70) |
| (30) | |
| 1 (very low pain) | 3 (30) |
| 0 (0) | |
| 2 (pain can be ignored) | 0(0) |
| 4(40) | |
| 3 (strong, but well borne) | 0(0) |
| 4(40) | |
| 4 (very strong, concentration difficult) | 0(0) |
| 4(40) | |
| 5 (intolerable) | 0(0) |
| 2(20) | |
| Description of pain** | |
| Dull 3(30) | 6(60) |
| Burning0(0) | 1(10) |
| Sharp 0(0) | 0(0) |
| Throbbing | 0(0) |
| 0(0) | |
| Location of pain*** | |
| Low back3(30) | 7(70) |
| Mid back0(0) | 2(20) |
| Neck 0(0) | 1(0) |
| Pain duration (% of 120 h) | |
| 0-25 0(0) | 0(0) |
| 26-50 0(0) | 0(0) |
| 51-753(30) | 2(20) |
| 76-1000(0) | 5(50) |
| Time of maximum pain | |
| Evening or night | 3(30) |
| 7(70) | |
| Morning0(0) | 0(0) |
| Method of easining pain**** | |
| Fetal position | 0(0) |
| 4(40) | |
| Forced compression | 3(30) |
| 7(70) | |
| Painkillers | 0(0) |
| 2(20) | |

*Some described a range of pain
**Some respondents specified more than one type
***Some respondents specified more than one location
****Some respondents used more than one method anges in microgravity.
In: Results of the Life Sciences DSOs Conducted

SUMMARY


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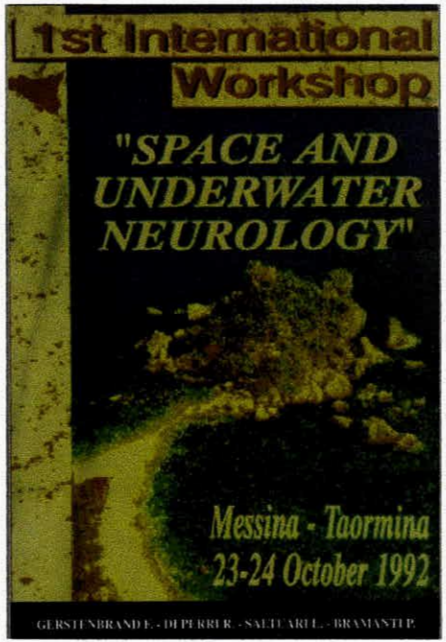



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