

NEUROLOGICAL FINDINGS AFTER 72 HOURS WATER IMMERSION

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SUMMARY

Neurological changes caused by water immersion simulated microgravity have been investigated in four male volunteers. All the investigations have been performed in the space laboratories for ground based experiments of the IBMP Moscow. Neurological investigations have been carried out before as well as 24, 48 and 72 hours after they have been placed into the horizontal water immersion basin. Cerebellar dysfunction, signs of deteriorating function of the peripheral nerve system as well as of the posterior tract and frontal lobe symptoms have been observed. Besides this disturbances compensated cerebral microsymptoms occurred more pronounced in 2 of the 4 volunteers.

Decreased muscle tonus, decreased muscular power, hyperreflexia (4), disturbances of coordination and altered biomechanical structure of locomotion (5,6) etc. have been described. Similar alterations as occurring in response to real microgravity have been reported also after long term bed rest or water immersion.

METHODS

Four male volunteers (24, 26, 27, 42 a) have been placed for 72 hours into the horizontal water immersion basin. Detailed neurological investigations by two neurologists at the same time have been done before the experiment and 24, 48 and 72 hours thereafter. The experiments took place in December 1989 (volunteer M & S) and in April 1990 (volunteer F & B). The neurological examination, part of a detailed investigation program, had been done according to a special prepared check list. The Innsbruck Neurological Investigation Scale with a range from -4 to +4 had been worked out in order to enable a comparison, respectively a computerized documentation and analysis of neurological findings.

INTRODUCTION

Neurological changes caused by water immersion simulated microgravity have been investigated in four male volunteers. This investigations, which did emphasize on neurological alterations, postural reflexes and cerebellar functions, took place at the IBMP laboratories for ground based experiments in Moscow. Only the neurological changes observed during and after 72 hours immersion will be reported in this paper. As it was shown in previous studies (1,2,3) a decrease of G-loads induces besides other disturbances disorders of all parts of the motor regulation.

RESULTS

The neurological findings before the experiment (A) as well as the outstanding changes occurring during and after 72 hours water immersion (B) will be presented in Tab.1 to 4

DISCUSSION

Space conditions can be simulated for a short time by parabolic flights or for a longer period, but incompletely by bed rest or water immersion model. The latter seems to be a useful method for ground based investigations of microgravity influence on the nervous system. As it was shown in previous studies (3,7,8) there exists a close similarity between the effects of short time real microgravity and immersion. However the dimension of these changes is different. The motor disorders caused by immersion are more markedly as those occurring after space flights of equal duration. Perhaps it can be a cause of the summation of support unloading effects and hypokinesia. Microgravity induces a change of the sensomotor system by altered motor functions and consecutive proprioceptive inputs. In the absence of support loads the tonus of the antigravitational muscles decreases (9,10). This decrease of muscle tonus was to find in all the 4 volunteers also. The decrease of the muscle tonus and of the reflex amplitude in connection with the occurrence of other cerebellar signs could be caused by a deafferentiation. The frontal lobe symptoms as well have most likely the same cause. Muscle tonus and reflex amplitude decrease are well known symptoms of cerebellar dysfunction. In all 4 volunteers not only the above mentioned changes in muscle tonus and reflex amplitude was found but also other signs and symptoms of cerebellar dysfunction as ataxia, rebound phenomenon and in 2 cases an increasing nystagm. Besides this disturbances compensated microlesions of the CNS seemed to decompensate in simulated microgravity. In two volunteers with slight neurological deficits found at the pre - experiment investigation these deficiencies could be seen more prominent even after 24 hours immersion.

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