# MS-C1

## MS-C1-04

### Neurological Effects of Water Immersion

F.Gerstenbrand, M.Berger, M.Marosi, A.Muigg, L.Grill
Innsbruck/Austria
I.B. Kozlovskaya, B. Babaev, A. Sokolov, M. Borisov
Moscow/UdSSR

Weightlessness can be partially simulated for a short time by parabolic flights and for a longer period by bed rest or water immersion model. The latter seems to be a useful method for ground based investigations of microgravity.

Microgravity simulating immersion model tests were performed in 10 volunteers. All except one, who refused to stay in immersion after six hours due to intolerable motion sickness, stayed for 72 hours in the horizontal immersion basin.

The neurological investigations took place 2, 24, 48 and 72 hours thereafter.

In nearly all cases we found disturbances of eye motion, decrease of muscle tone, deterioration of fine motor functions, a slowly increasing pathology of cerebellar functions and also increasing frontal signs.

## MS-C1-05

**PATHOGENESYS OF NEUROPSYCHIC DISTURBANCES IN MAN IN SPACE FLIGHTS AND IN DEEP WATER DIVING.**

**Abraham M. Genin**
**Institute of Biomedical Problems, Moscow, USSR**

**Professional activity of cosmonauts and divers is linked to several factors, that can cause functional neuropsychic disturbances.**

**The specific factor of spaceflight is weightlessness that can cause the appearance of space disorientation, different kind of illusions and vestibular autonomic reactions. The specific factors of diving appears to be: i) high density of inspired gas mixture combined with a high resistance of the respiratory equipment, that can provoke an appearance of feeling of suffocation, followed by feeling of panic; ii) high partial pressure of oxygen and filling gases; iii) high general pressure, causing the development of high pressure neurosyndrom.**

**Some of nonspecific factors are common for cosmonauts and divers. Those are: i) partial deprivation, linked to a long term being in isolated environment; ii) high level of risque linked to long term existence in aggressive for human body environment; iii) work activity under these conditions, etc.**

**Descriptions of neuro-psychic disturbances that were recorded in space flights and diving will be described. Measures needed for their corrections are analyzed.**

## MS-C1-06

DEEP SEA NEUROLOGY - PAST, PRESENT AND FUTURE

J.A.Aarli (Bergen, Norway)

Deep diving to 200 m below sea surface (msw) is industrial routine in many countries. Commercial exploitation of North Sea oil fields will necessitate diving operations down to 300-350 msw. The work of divers for longer periods at such depths can only be obtained through saturation diving.

Saturation diving consists of three phases, compression, saturation and decompression. The saturation or bottom phase comprises the period when maximal pressure is attained and the divers can perform work.

Experience has shown that man compressed with helium and oxygen to depths greater than 150 msw will develop symptoms of CNS dysfunction. The neurological symptoms and signs observed under such conditions constitute the high pressure nervous syndrome (HPNS). The dominating symptoms of the HPNS are tremor, reduced tempo and motor fatigue, mental and behavioural changes, vertigo, dizziness and nausea. The changes occuring during the HPNS have been regarded as reversible. The focal neurological dysfunction which may occur is assumed to reflect a pre-existing and clinically silent minimal brain lesion which may be activated or unmasked during the extensive functional disturbances caused by the increase in pressure.

If environmental pressure is reduced too quickly, gases disolved in the tissues may form bubbles. Formation of invascular gas bubbles may lead to serious neurological manifestations. The decompression tables employed in commercial deep diving carry wide safety margins. Serious decompression disorders in deep diving are therefore extremely scarce. They are much more common in sport diving, when rapid ascent from more shallow depths is performed.

The compression and decompression phases both represent medical risks to the diver and require intensive medical control.

## MS-C1-07

ACUTE AND LONG TERM NEUROLOGICAL HEALTH EFFECTS OF DEEP DIVING. Kari Todnem, Department of Occupational Medicine, Haukeland Hospital, N-5021 Bergen, Norway.

Eighteen divers (age range 24-33 years) participated in 1 dive each to 360 metres of seawater (msw), breathing a mixture of helium and oxygen. The neurological symptoms observed during the dives were equilibrium disorder, sleep disturbances, fatigue, nausea, loose stools, stomach pain, tremor, mental disturbances, reduced appetite and headache. By use of statistical factor analysis it was interpreted that these symptoms presumably were related to functional disturbances in the brain stem and cerebellum. We advocate that divers with signs of central or peripheral nervous system dysfunction should not participate in deep diving.

After the deep dives, 2 divers had mild ataxic signs and changed electronystamography, and 1 had impaired vibration sense in one lower extremity. Two divers had abnormal EEGs. No changes were found in the magnetic resonance imaging brain scans.

Forty saturation divers (age range 24-49 years) were examined 1 to 7 years after their last deep dive (190-500 msw). Four had by then lost their divers' licence because of neurological problems. The results were compared to 100 non diving control subjects. The divers had significantly more symptoms from the nervous system, more abnormal neurological findings and more abnormal EEGs. The neurological symptoms and signs were highly significantly correlated to the deep diving, and also to ordinary saturation diving and the prevalence of decompression sickness. Two divers had had seizures, 1 had had episodes of transitory cerebral ischemia, and 1 had had transitory global amnesia. It is concluded that deep diving may have a long term effect on the nervous system of the divers.

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Autor: Franz Fazekas; Erich Schmutzhard; Karl Zeiler

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