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Environmental Physiology

DO CLIMBS TO EXTREME ALTITUDE CAUSE BRAIN DAMAGE?

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THE history of mountaineering, like so many other human activities, is one of continual attempts to better the achievements of others. The primary goal used to be to conquer the world's highest peaks. Now this has been done, climbers set themselves new objectives. They want to reach the summits without oxygen, during the winter, by the most difficult routes, or unroped.

The past few years have seen a fashion for climbing without supplementary oxygen. Reinhold Messner has so far conquered all but two of the fourteen 8000 m (26 200 feet) peaks in the world without supplementary oxygen. Other climbers have made winter attempts to reach the summit of Mount Everest without oxygen. Apart from the obvious disadvantages of cold and violent weather, winter poses substantial additional hypoxic stress because of the lower barometric pressure.[1]

Many climbers and doctors have asked whether brain damage occurs under these extremely hypoxic conditions. There are two separate issues. One is whether central nervous system (CNS) function is impaired at great altitudes; all the evidence indicates that it is, though there are few controlled measurements. The other issue is more interesting: does exposure to the extreme hypoxia of these great altitudes cause residual impairment of CNS function? Although this question has been hotly debated, Townes and colleagues' 1984 study[2] strongly supports the occurrence of brain damage, at least for many months after such climbs in some people. Many climbers, and even some of their doctors, have been reluctant to accept these unpalatable conclusions, and it seems important that the medical community should be better informed about these possibilities.

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IMPAIRED CNS FUNCTION AT HIGH ALTITUDE

Given the vulnerability of the CNS to periods of severe hypoxia, for example in swimming pool and anaesthetic accidents, it should come as no surprise that the extreme hypoxia of great altitudes causes functional impairment. However, careful measurements on climbers are rare. Some data are available from medical research expeditions and studies in low-pressure chambers, but most of the observations are anecdotal.

In 1937 McFarland[3] showed impairment of neuromuscular coordination of lowlanders during 3 months' exposure to altitudes up to 6100 m. Sharma et al[4,5] studied soldiers who spent up to 2 years at an altitude of 4000 m. Psychomotor performance, such as eye-hand coordination, declined during the early stages of altitude exposure; the changes were significant after 1 month and became worse thereafter. Electroencephalographic changes have been seen in lowlanders after several days at 3500 m and 4300 m.[6,7] Occasionally, there have been clear indications of local hypoxic brain damage, such as transient aphasia.[8]

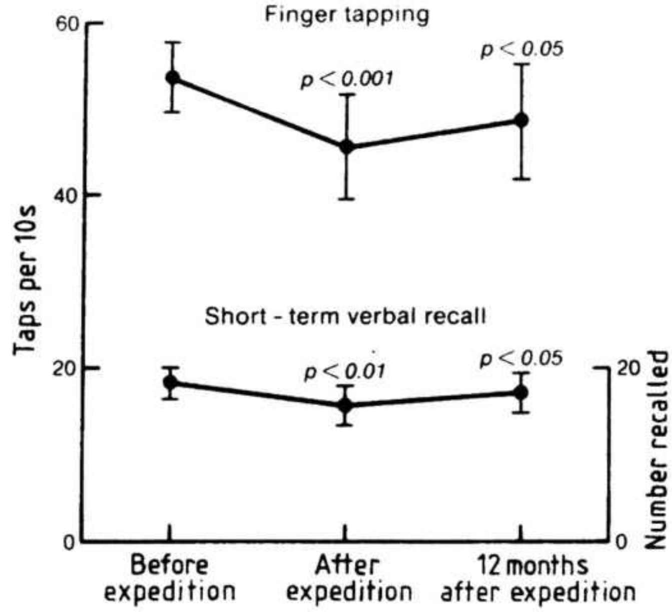
In contrast to the few studies at high altitude, there have been many accounts of hallucinations and bizarre behaviour of climbers during expeditions. For example, Smythe gave a dramatic account of pulsating cloud-like objects in the sky during the 1933 Everest expedition.[9] He also reported a strong feeling that he was accompanied by a second person; he even divided food to give half to his non-existent companion. The mountaineering literature is full of examples of irrational decisions, many of which have led to disaster.

PERSISTENT CNS DYSFUNCTION AFTER RETURN TO SEA LEVEL

It is one thing to show that the severe hypoxia of high altitude affects neuropsychological function, but another to claim that residual impairment exists after the climber has descended to sea level. Yet evidence is mounting to suggest this.

Townes et al[2] found clear evidence among 21 members of the American Medical Research Expedition to Everest of residual abnormalities of neuropsychological performance on return to sea level after about 3 months at altitudes of 5400–8848 m. The tests included the Halstead-Reitan battery, repeatable cognitive-perceptual-motor battery, selective reminding test, and the Wechsler memory scale. Measurements made before and immediately after the expedition (see figure) showed significant abnormalities in motor coordination for both hands (finger tapping test), short-term and long-term verbal recall, and the aphasia screening test (Halstead-Wepman). The same tests were repeated 12 months later and persistent abnormalities were found in the finger tapping test for both hands and the trials to criterion section of the Wechsler memory scale. Further studies have shown that abnormalities of motor coordination have continued beyond 24 months after the expedition.

Ryn[10,11] also found persistent abnormalities in a group of 12 male and 10 female Polish climbers several weeks after a Himalayan expedition. Half of the male climbers who ascended over 5500 m experienced symptoms similar to an acute organic brain syndrome, and for several weeks after the expedition they had changes in affect and impaired memory. 11 of the 30 climbers had electroencephalogram abnormalities immediately after the climb.



Results of finger tapping and short-term memory tests before, immediately after, and 1 year after an expedition to Mount Everest.

Data means and standard errors. P values for comparisons with pre-expedition measurements by Wilcoxon signed-rank tests, from Townes et al.[2]

Not everyone has found postexpedition abnormalities. For example, Clark et al[12] tested 22 mountaineers before and 16–221 days after Himalayan climbs above 5100 m with a battery of psychological and neuropsychological tests but found no evidence of persisting cerebral dysfunction. Other physicians[13] have also claimed that exposure to high altitude does not cause residual damage, though not on the basis of neuropsychological testing.

DANGERS OF MOUNTAINEERING

Mountaineering is a dangerous sport, especially in the very high mountains of the Himalayan range and the Andes. For example, there have been over 100 deaths on expeditions to Mount Everest, an average of approximately 2 people per expedition. Most of the deaths have been caused by falls, accidents in the unstable icefall, or exposure following exhaustion.

In the light of these statistics, it could be argued that a small degree of residual brain damage is insignificant. Yet it seems important to point out that the risk exists, particularly since the sport attracts many professional people. Many doctors believe that professional boxing should be discouraged because of the possibility of brain injury. Perhaps the present fashion for climbing to extreme altitudes without supplementary oxygen falls into the same category.

The data from the American Medical Research Expedition to Everest were collected and analysed by Dr B. D. Townes, Dr T. F. Hornbein, Dr R. B. Schoene, Dr F. H. Sarnquist, and Dr I. Grant.

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Round the World

From our Correspondents

China

FAMILY PLANNING

A new programme which offers further training in managemen to China's 5000 senior family planning administrators has bee developed by the state family planning commission of the People' Republic with financial help from the UN Fund for Populatio Activities (UNFPA) and the World Health Organisation. A ne training college has been established at Nanjing. 130 students ar admitted annually for a 2-year residential course; 1500 studen follow a 3-year correspondence course administered via 14 satelli training centres; and there are short courses of 1–2 month UNFPA has contributed over $2 million and technical guidance t the programme. WHO has recruited a series of consultants an guest lecturers to visit Nanjing for short periods. In addition, senio administrators and faculty staff of Nanjing have visited training centres overseas.

India

ORS: "ESSENTIAL" BUT NOT A DRUG?

CAMPAIGNERS for a rational drug policy in India have pointe out that oral rehydration salts (ORS) find no place among the 9 drugs named by the Government in its essential drugs lis Although ORS should definitely fall in the essential category, th fundamental point is: should ORS be defined as a drug at all? Th question before the rational health movement is: should the demand inclusion of ORS as an essential "drug", or should the demand recognition of the fact that ORS is not a drug in th conventional sense and therefore its production should not b hampered by drug policy regulations?

According to LOCOST, a Baroda-based health grou promoting rational therapeutics, the fact that ORS is classified as drug has made it difficult to organise increased production by smal units which could ideally take up ORS production. In th experience of this group, there is virtually no state encouragemen for production of ORS and many Government health officials ar not even aware of ORS. They also point out that ORS productio requires a drug-manufacturing licence, which means satisfyi such preconditions as a work premises of 800 sq ft and su requirements as a dehumidifier and an air conditioner.

It has been suggested that if ORS were classified as a food r than a drug, its production in sufficient quantities and at a low would be more feasible. At present the electrolyte packs o market are brand-name products manufactured by the big firms and highly priced. The packs are also being promo "thirst-quenchers" for hot days. In fact the Indian edit MIMS (Monthly Index of Medical Specialities) lists the elec products not under "antidiarrhoeals" but in the "nutrition" s tucked away among the minerals and tonics.

Even going by this logic, an ORS pack (with its kitche ingredients) would qualify well as food rather than as drug. itself emphasises that oral rehydration is a vital "non-drug" t for diarrhoeal disease. If classifying ORS as food instead would result in cheaper and higher production, the pros and such a move need to be seriously examined.

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