TREATMENT OF MOUNTAIN SICKNESS

International Society for Mountain Medicine Newsletter, **10** (3): 10-12 (July 2000)

Austrian Society for Mountain and Altitude Medicine
RESULTS OF THE INTERNATIONAL CONSENSUS-SYMPOSIUM
CASTLE OF KAPRUN / SALZBURG OCTOBER 10, 1998

The use of the portable hyperbaric chamber

- Regular acclimatization (climb slow, sleep low etc.) is always safer than carrying a portable hyperbaric chamber.
- The hyperbaric chamber is unsuitable for prevention or treatment of mild AMS because it prevents or at least slows down acclimatization.
- It is well proven that the use of the hyperbaric chamber is successful in treating severe AMS, HAPE or HACE.
- The priority sequence of emergency measures with cases of severe AMS / HAPE / HACE should always be: (1) descent/evacuation, (2) oxygen / drugs, (3) hyperbaric chamber.
- A hyperbaric treatment does not substitute for descent or evacuation, but improves the physical condition of the patient for subsequent and always essential descent or evacuation.
- A hyperbaric treatment should always be performed in combination with special drugs. The patient's upper body has to be in an upright position. The hyperbaric treatment should always lead to a significant improvement within 90 minutes.
- If there is no improvement within 120 minutes, complications or other reasons for the patient's still poor physical condition, e.g. thrombembolism, deterioration, hypothermia, severe dehydration, must be considered.
- Treatment with oxygen plus drugs is generally favoured in all cases of extreme HAPE / HACE (in particular with loss of consciousness), but the amount of bottled oxygen is limited whereas the use of the hyperbaric chamber has no time limit.
- In severe cases, oxygen breathing during the treatment with the portable hyperbaric chamber is recommended. In a portable hyperbaric chamber there is no danger of fire or explosions.
- The logistic problems of oxygen bottles as well as of the portable hyperbaric chamber are quite common: They are hardly ever available where they are urgently needed. Both oxygen bottles and hyperbaric chamber should therefore be stored in the highest camp.
- It is a common belief that a portable hyperbaric chamber must be carried at least on every commercial altitude trip on legal grounds (liability of the organizer), although up to date neither particular legal rules nor punishments exist (Austria, Germany).
- In small teams or in the Alps the hyperbaric chamber is unnecessary.
- The portable hyperbaric chamber should especially be carried in an area

without a proper possibility for an immediate and efficient descent to lower altitudes.
- Only specially trained persons should treat a patient with a portable hyperbaric chamber.
- Because the handling of a hyperbaric chamber at extreme altitudes is particularly strenuous, the upper limit for its use might be approximately 21,000 ft. Above this altitude emergency oxygen bottles plus drugs appear to be preferable.
- In case of doubt, apart from cardiac arrest, there is no contraindication to the hyperbaric treatment. Patients with loss of consciousness can also be treated in a hyperbaric chamber if their body position is appropriate.
- In Europe, the CERTEC bag is more popular than the Gamow bag because of the maximum pressure (165 versus 104 Torr, which means about 800 simulated altitude metres lower), of the lower weight (8 to 5.6 kg), because of the ease getting into the bag and, last not least, of the lower price.

Drugs for mountain sickness

Acetazolamide: The *prophylactic* effect of acetazolamide is scientifically proven, but it has to be judged as a sort of doping and should therefore not be used regularly. Exceptions: AMS-susceptible individuals, if a slow ascent is impossible, and for the unacclimatized rescuer in high and extreme altitudes. HAPE cannot be prevented by acetazolamide.
Treatment with acetazolamide: In case of mild AMS there is no need for acetazolamide. In case of severe AMS, acetazolamide is less efficient than dexamethasone. A HAPE patient could die by acetazolamide due to the aggravation of the respiratory acidosis.

Nifedipine: *Prophylactic* use of nifedipine can be recommended only for extreme HAPE-susceptible individuals in critical areas (e.g. Lhasa, La Paz). *Treatment* of HAPE: Only slow-release nifedipine should be used due to the reduced risk of dangerous side-effects.

Dexamethasone: Should not be used for AMS-*prevention* (high risk of side-effects, doping). *Treatment* with dexamethasone is recommended in all cases of acute mountain sickness although one has to consider that there is no effect with HAPE. Dexamethasone is the only drug which can be used both orally and by injection.

"Triple therapy": Can be applied in severe cases if the situation is not clear: *dexamethasone plus nifedipine plus oxygen/hyperbaric chamber.* Acetazolamide should not be used as a component of a "triple therapy".

Ibuprofen, naproxen, aspirin: Used for altitude headache if there is no history of peptic ulcer. Unsuitable for prevention of altitudeheadache.

Theophylline: For altitude-related sleep disorders more effective and with fewer side-effects than acetazolamide.

The importance of medical care being taken by a trekking or expedition doctor

The current need of a doctor's care is due to the following facts:

- Increasing tendency of tourism at high and extreme altitudes.
- High risk of morbidity and mortality at high and extreme altitudes.
- Poor rescue and hospital facilities in most of the countries with high mountains.

Risks of medical care by non-doctors:

- In outdoor areas the limitations of usual first aid will soon be reached.
- The lack of medical knowledge may lead to dangerous diagnostic errors in particular with regard to acute mountain sickness.
- Rare but potentially serious side-effects of altitude-related drugs.

How to cover the costs of an expedition-doctor's attendance ?

- Reduction of the travel expenses (usually 10 to 30 percent).
- Refund of all travel expenses if the doctor's professional involvements have thwarted his own travel or mountaineering goals.
- The costs of transport and insurances have to be carried by the organizer.
- The costs of medical treatment should be covered by a sufficient travel health insurance.

Qualifications of a trekking doctor:

- Education and training in theory and practice of trekking and expedition medicine.
- Knowledge in general medicine, sports medicine, emergency medicine and travel medicine. The ideal professional background of a qualified trekking doctor might be that of an experienced general practitioner.
- Excellent physical fitness and mental stability.
- Government certificate to be authorized to work as a physician.

Additional qualifications of an expedition doctor:

- Good high altitude climber.
- Knowledge and training in mountain rescue methods.

Round-table-experts and participants of the consensus-symposium:
Prof.Dr.Peter Bärtsch (University of Heidelberg, Germany), Univ.-Doz.Dr.Franz Berghold (University of Salzburg, Austria), Prof.Dr.Helmut Biedermann (University of Innsbruck, Austria), Prof.DDr.Mag.Martin Burtscher (University of Innsbruck, Austria), Dr.Johanna Dostal (Austrian Mountain Rescue Service), Dr.Ulf Gieseler (Hospital of Speyer, Germany), Edi Koblmüller (mountain guide, Linz, Austria), Dr.Karl Pallasmann (Austrian Mountain Rescue Service), Dr.Wolfgang Schaffert (German Society for Mountain and Expedition Medicine), Günter Sturm (DAV

Summit Club, Munich, Germany), Dr.Robert Wallner (Public Prosecutor, Central Court of Innsbruck, Austria) and 250 participants from Austria, Germany, Italy, Switzerland, Netherlands and Czechia.

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 Last modified 01-Aug-2001