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CONSENSUS STATEMENT OF THE UIAA MEDICAL COMMISSION

VOL: 13

People with Pre-Existing Conditions Going to the Mountains

Intended for Physicians, Interested Non-medical Persons and Trekking or Expedition Operators

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2008

1 Introduction

As more and more people are taking holidays at altitude, many of them elderly, there are going to be a number suffering from chronic medical conditions. How should they be advised?

1.1 Effect of altitude and the mountain environment

At altitude the low barometric pressure means that the oxygen inhaled is at a lower pressure than at sea level. This in turn means that the oxygen transport system of the body is operating under difficulties and any chronic condition which affects this system will make matters worse. Thus diseases of the cardio-respiratory system are especially likely to interfere with performance at altitude.

Apart from the effect of altitude itself, the mountain environment poses other hazards. There is a drop in temperature as altitude is increased. The great ranges are situated mostly in under-developed countries and in wilderness areas where gastro-intestinal problems are common and medical help uncertain. Altitude holidays usually involve quite strenuous exercise and put a strain on the joints, especially knees, hips and backs. Finally the different culture and life style of such a holiday may impose psychological stresses which may be too much for some people unused to the difficulties and privations of such a trip.

There is also the consideration that on an expedition or trek the aphorism, “No man is an island” applies with greater force than in normal urban life. One member’s illness affects the whole team and may even imperil the safety of other members. Therefore it is ethically imperative that if a person knows he/she has some pre-existing condition which might affect his performance, he should make it known, at least to the leader or medical officer if there is one.

1.2 Specific conditions

A few of the commonest conditions are discussed here. Further reading is suggested at the end of the paper.

2 Respiratory conditions

2.1 COPD

Conditions such as chronic bronchitis, emphysema (COPD) and other lung conditions which cause breathlessness at sea level are obviously going to cause even more shortness of breath at altitude. Such patients are likely to experience distressful dyspnoea and become hypoxemic. They may also have increased pulmonary pressor response and develop pulmonary hypertension. This may put them at increased risk of high altitude pulmonary edema (HAPE).

General recommendations:

- If the patient suffers from dyspnoea at rest or during mild workload (<100 W) at sea level, he / she should not go to altitude, even not to modest altitudes (800 – 1500m) [1].
- If there are no symptoms at sea level an altitude of 1500 to 2000m will be possible, but this depends on the type and the style of the travel. Check the individual and actual limit carefully! In average a decrease of SaO_2 of about 5% compared to sea level can be expected at this altitude [1].
- No altitude exposure in the case of decompensated cor pulmonale, since this would add a significant load to the right ventricle due to pulmonary hypertension [1].
- If on steroids the dosage should be doubled above 3000m, because corticotrophin is increased in hypoxia [1].

Note: No abrupt increase of altitude (cable cars, helicopter flights), if there is any doubt that sufficient pulmonary reserve exists [1]!

Note: Advise special caution to Blue bloaters (reduced ventilatory drive in hypoxia) [1]!

Note: In the case of coexistent cardiac insufficiency, the altitude-related decrease of performance is significantly increased compared to healthy persons. [1]

2.2 Asthma

Asthma sufferers usually find they have less trouble at altitude [2]. Although they may be breathing cold dry air, which can be a cause of bronchospasm, because of the absence of the allergens in the air at altitude, in the majority of cases, they have less wheeze. The increased sympathetic drive and adrenal steroid output may also help. Studies of bronchial reactivity in asthmatic patients, have shown improvement (reduction) in their reactivity to hypotonic or methacholine aerosol [3]. However, research has only been conducted on mild, well controlled cases. If the patient suffers from dyspnoea at rest or during mild workload (<100 W) at sea level, he / she should not go at altitude, even not modest altitude (800 – 1500m) [1]. Patients should, of course, take a good supply of their usual medication and continue taking it regularly. Inhalers should be kept warm (e.g. transported on the body), and powder inhalers should also be kept dry. The dosage of corticoids should be doubled above 3000m, because corticotrophin is increased in hypoxia [1].

2.3 Cystic Fibrosis

With improved management of this condition, many patients are reaching adulthood and some may wish to embark on an altitude holiday. Most of the research into the effect of modest altitude in this condition has been done with a view to assessing fitness to fly in commercial aircraft. Therefore most studies have looked at the effect of 2-3,000 m altitude equivalent. Luks and Swenson recommend, in their review, that if, on breathing 15% O_2 the PaO_2 drops below 50 mmHg, supplementary oxygen

should be provided on the aircraft [3]. Of course, during an altitude holiday patients will take at least mild exercise which will lower PaO_2 even more. A hypoxic inhalation test should therefore include exercise. However, this test is not very specific and Luks and Swenson suggest that if the FEV_1 is less than 50% predicted, patients should travel with supplementary oxygen on flights. For an altitude holiday a more stringent threshold would be appropriate depending on the anticipated altitude. Two patients with FEV_1 less than one litre, developed pulmonary hypertension and cor pulmonale on an alpine ski holiday [4].

2.4 Interstitial lung disease

Patients with interstitial lung disease, such as fibrosing alveolitis, sarcoidosis etc. will have both restrictive and gas transfer defects. They are therefore very likely to become breathless and develop low PaO_2. Unless their condition is very mild they should be advised against an altitude holiday.

3 Cardio-circulatory conditions

3.1 Symptomatic cardiac conditions

Clearly patients with symptomatic heart conditions (e.g. unstable angina, heart failure etc.) should not go to high altitude.

3.2 Systemic Hypertension

Patients with controlled systemic hypertension seem not to be at increased risk [5]. They should, of course, continue their normal medication. If possible do not use beta-blockers because they limit maximal workload [1]. Diuretic drugs may increase the risk of dehydration at altitude, if possible avoid them [1]. Some Alpha-1-Blockers may reduce breathing at altitude and therefore they may reduce performance [1]. Note that the normal response on arrival at altitude is an increase in blood pressure. This is thought to be due to a generalized increased sympathetic tone and is not pathological. However, it varies between individuals and possibly in time in a single individual. There is currently no evidence that this has any clinical significance.

3.3 Coronary heart disease

There is no principal contraindication for these patients to visit altitude, the individual advise depends on the actual clinical situation. It is proven, that “low risk patients” do not increase their cardiac risk if they go to moderate or even high altitude (e.g. Jungfraujoch, 3454m).

General recommendations [1]:

- Above 2500m significant reduction of the coronary reserve. Reduce workload!
- Up to 3000m possible, if the disease is stable and there are no symptoms during exercise at sea level
- Be careful during the first 3-4 days (slightly increased risk), no excessive exercise!

Note: acetyl salicylic acid therapy may increase the risk of retinal bleeding at altitude (and possible bleeding in gut as stated on pg 6, 3rd paragraph).

Note: Normally the risk of altitude related disorders is not increased. But some data indicate an increased risk for HAPE for patients with cardiac insufficiency [1].

3.4 Coronary Bypass Surgery, Angioplasty

Following successful coronary bypass surgery or angioplasty, patients who have good performance at sea level do not seem to be at risk of problems at altitude. Patients with angina controlled by drugs should certainly consult their cardiologist before considering an altitude trip. The question of whether altitude is a risk factor in the aetiology of coronary occlusion in previously asymptomatic people, is unknown but the best evidence is that altitude is not a significant risk factor for coronary artery occlusion [2].

Patients who have had valve replacements are advised not to take hard physical exercise and if they are on anti-coagulants that is a further factor in favor of an alternative holiday.

3.5 Arrhythmia

Increase of arrhythmia possible, but obviously the risk was overrated in the past [1]. Be careful in the case of electrolyte imbalance (e.g. caused by vomiting related to AMS, diarrhoea etc.). Cardiac pacemaker do not show any problems up to 4000m (there are no data from above 4000m) [1]. Be very careful if the arrhythmia increases by exercise! No altitude sojourn in the case of complex arrhythmia, cardiac arrest in history (at least for 1 year after the incidence), arrhythmia with cardiac syncope, or severe dysfunction of the left ventricle (ejection fraction <40%) [1].

3.6 Pulmonary hypertension

Data – although limited – indicate that altitude sojourn should be avoided for patients with pulmonary hypertension, in severe cases even for moderate or low altitude <1000m [1]. In any case take plenty of time to adapt properly to altitude, even for low altitudes between 600 and 1000m! Any rapid ascent (cable car, car or bus on a mountain pass) can cause acute decompensation [1]!

4 Blood disorders

Patients with **anaemia** will be more short of breath at altitude and some women of a reproductive age may have low iron stores so would benefit from taking iron tablets before going to altitude. A haemoglobin concentration of at least 9-10 g/dl is recommended for an altitude of 2000 – 3000m [1]. But for the majority of people these and vitamins are unnecessary. Patients with **bleeding** or clotting problems should not go to altitude. Although the effect of altitude on the clotting system is debated the remoteness from medical help is reason enough to advise caution. Similarly patients on **anti-coagulation therapy** (except aspirin, see below) for any reason should probably be advised to choose a holiday where medical help is readily available.

Patients with **sickle cell disease** also should not go to altitude. Even with **sickle cell trait** there is a 20-30% chance that altitudes above 2000 m may trigger a crisis [6], some patients showed acute symptoms already at 1600m [1].

Aspirin is taken by a number of people going to high altitude with the idea of reducing any risk of thrombotic problems due to the high haematocrit of altitude. We have no evidence either way for this practice but the usual precautions in taking aspirin (or any NSAIDs) must be stressed. There is some evidence that gastro-intestinal bleeding is more common at altitude [7] so the routine use of aspirin should be discouraged. The risk of retinal bleeding may also be increased at high altitude [1].

5 Endocrine disorders

5.1 Diabetes mellitus

Altitude itself does not have any effect on diabetes and many diabetics have enjoyed holidays in the mountains. Patients with well-controlled **Type 2 diabetes** should have no problems with altitude and the increased exercise may well help their condition by increasing their insulin sensitivity.

However, patients with **type 1** (insulin dependant) diabetes may get into trouble. The increased exercise on climbing days will lead to reduced insulin requirements and, if this is not allowed for, hypoglycaemia is a risk. On rest days the insulin needed will be similar to that at sea level when not exercising. Because of these variations patients are advised to use short acting insulin, have three to four injections a day with monitoring of their blood glucose. Both the patient and companions need to be aware of the risks of hypo- and hyperglycaemia and know how to recognize and treat these problems in the absence of medical help. Glucose monitors may under or over read at altitude though keeping the meter warm helps. There is also the problem of insulin storage on trek or on the mountain. Insulin must not be allowed to freeze or get too hot. Insulin and some test devices are also sensitive to UV light [1]. Test devices will give too low results of blood glucose concentration if their temperature is <14°C and completely fail <0°C [1].

Brubaker refers to a number of studies showing that diabetes is not a risk factor for AMS though symptoms of hypo- or hyperglycaemia can be confused with those of AMS [8]. She discusses the results of three expeditions to Kilimanjaro, Cho Oyu and Aconcagua, in which diabetic patients were compared with non-diabetics. The results vary but in general, as one might expect, the success rate in reaching the summit was lower for diabetic patients. Advice and support for diabetic patients who climb or trek to altitude can be sought from the organization, “Mountains for Active Diabetics” (www.mountain-mad.org).

Diabetic patients should be trained to differentiate between symptoms of AMS and hyper-/hypoglycaemia, which is sometimes difficult [1]. During the tour patients should carefully monitor their fluid balance, because they are at increased risk for ketoazidotic coma [1]. Severe or “brittle” diabetic patients should not go on high altitude adventure holidays. Diabetic complications such as diabetic retinopathy, peripheral arteriopathy, coronary heart disease, and others may be a risk [1]. Never use acetazolamid in diabetic patients due to the danger of ketoacidosis [1]! Some data indicate that diabetic patients are at risk for “polar hands” (painful fissuring of fingertips) at altitude. They should use lipid regulating products [1]. Do not wear shoes that are restrictive in sizing or too tight.

5.2 Steroid therapy

Patients who have been on steroid replacement therapy for adrenal failure, should increase their steroids on going to altitude to cover the increased requirement due to the stress of altitude

6 Gastro-intestinal disorders

The commonest medical problems amongst trekkers are usually diarrhoeal disorders and anyone with a chronic pre-existing condition of this sort, e.g. **Crohn’s disease or ulcerative colitis** should probably not plan this sort of holiday. **Peptic ulcer** should be treated before going into the high mountains. **Note:** antiacid drugs may increase the risk for traveller’s diarrhoea and other oral infections. Similarly conditions such as **hemorrhoids, fissure in ano** etc. considered trivial at sea level can cause real problems in the mountains and need to be dealt with before the trip. It seems that gastro-intestinal hemorrhage is more common at altitude though the mechanism is not clear. Aspirin, non-steroidal anti-inflammatory agents (NSAIA) and alcohol are risk factors [7].

7 Neurological conditions

7.1 Migraine

Many migraine sufferers find that ascent to altitude triggers an attack, often a severe one with neurological symptoms. Intense light may also trigger an attack, therefore patients should consequently wear good sunglasses at altitude [1]. It can be difficult

to distinguish this from AMS or even HACE although the headache of AMS is not usually unilateral, as it is typically in migraine. Migraine sufferers should take a supply of the drugs that usually help them and use the drugs at the first sign of an attack. If in doubt about the diagnosis, especially if symptoms persist after using drugs which normally relieve symptoms, the patient should be treated as for AMS or HACE (see UIAA Consensus Statement No.2).

7.2 Cerebro-vascular disorders

Patients with known or suspected cerebro-vascular problems such as TIAs, previous strokes or carotid artery stenosis should probably be advised against altitude travel because of the risk of thrombosis with the high haematocrit. **Note:** in the case of TIA there is a 5% risk of a second incidence in the first year. Later the risk decreases significantly and altitude travel may be o.k. again.

7.3 Epilepsy

Contrary to what might be expected, there is no evidence that altitude increases the risk of an epileptic seizure, so patients whose epilepsy is well controlled can enjoy holidays at altitude with the same confidence as would apply to hill walking at low altitude. Obviously they should continue to take their anti-epileptic drugs regularly. A period of at least 6 months free of fits prior to ascent to high altitude (>3500m) is strictly recommended [1]. Lay persons may confuse epilepsy with HACE. If there should be any doubt treat for HACE [1]!

8 Joints and ligaments

A trek, particularly long down-hill sections, will reveal even slight weaknesses in weight bearing joints. Again this is not due to altitude itself and would-be trekkers can test themselves out at low altitude. NSAIDs are valuable in this area and a good supply of various drugs should be taken. They should be started early (taken on a full stomach and in adequate dosage rather than being heroic about the pain.

9 ENT and dental problems

Nasal polyps which interfere with breathing should be dealt with prior to the trip as should any outstanding dental problems. Dental abscesses seem to be very common at altitude, possibly as a reflection of reduced immune function. They can usually be kept under control by antibiotics until return home.

10 Obesity

Obesity has been reported as being a risk factor for acute mountain sickness [9], [10]. At night obese individuals may suffer from a greater fall in arterial PO_2 as the weight of the abdomen interferes with normal lung expansion. The repeated episodes of hypoxemia lead to increased pulmonary hypertension. In addition, they are more likely to have sleep disorders with, in particular, obstructive sleep apnoea during which the arterial PO_2 can fall precipitously.

11 Sleep disorders

Obstructive sleep apnoea is common in obese patients but can also be found in non-obese subjects. There have been no studies in such patients but the repeated episodes of arterial desaturation may result in pulmonary hypertension. At altitude such episodes will result in more severe desaturation and such patients are likely to be at risk of both AMS and HAPE. If they are on CPAP and have to travel to high altitude they should certainly continue CPAP at night. Nifedipine should be considered as prophylaxis for HAPE.

Central sleep apnoea is a feature of high altitude in otherwise healthy subjects. If patients suffer from this problem at sea level they may well be more at risk at altitude. Acetazolamide in small doses (125 mg twice daily) may help [3].

12 Mental outlook

For the majority of people, venturing into the high mountains is a wonderful experience even if, at times, the conditions are harsh and uncomfortable. Most have graduated via family trips into the hills, short camping trips near home, hill walking etc. But some suddenly get the idea that they want to make some big trip with no previous experience and have quite unrealistic ideas of their own performance. Sometimes all works out well and they adapt to what is a very different life style with no problem but others are clearly psychologically quite unsuited to it and become psychiatric casualties, to the distress of themselves and their companions.

13 Summary

An account of this sort inevitably focuses on the gloomy side. Many people with chronic conditions can nevertheless enjoy holidays in the mountains. The important thing is to assess the situation realistically, take advice, be honest with oneself and one’s companions and tailor the trip to one’s abilities.

14 References

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10. Ri-Li, G., et al., *Obesity: associations with acute mountain sickness.* Ann Intern Med, 2003. **139**(4): p. 253-7.

15 Further reading/resources

- Two papers as the “Featured Topic” in: *High altitude Medicine & Biology* Summer issue 2007, Vol 8
- Wu,TY. et al. Who Should Not Go High, p88-107
- Baumgartner RW. et al. Going High with Preexisting Neurological Conditions p108-116
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History of this recommendation paper:

The first edition was written by J.S. Milledge (1996). At the UIAA MedCom Meeting at Snowdonia in 2006 the commission decided to update all their recommendations. The version presented here was approved at the UIAA MedCom Meeting at Adršpach – Zdoňov / Czech Republic in 2008.