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REVIEW

Pre-existing cardiovascular conditions and high altitude travel

Consensus Statement of the Medical Commission of the Union Internationale des Associations d'Alpinisme (UIAA MedCom) Travel Medicine and Infectious Disease

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Summary The number of persons visiting high altitude regions for various purposes (recreation, business etc.), and the age of people who do so, increases. Therefore there are more and more patients who need specific and individual advice to prevent emergency situations at altitude and to deal with emergencies if the safety strategy should fail.

Since literature concerning cardiocirculatory diseases at altitude is scarce and studies with a controlled setting and high evidence level are missing, UIAA MedCom has checked all available literature for specific information to enable physicians who are active in travel or high altitude medicine to advise the patients at the highest possible level of evidence. It must be pointed out that there are several other medical fields where such information is mandatory, e.g. in occupational medicine, when employees depart to high altitude destinations for business purposes.

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The recommendations are based on a detailed literature research (databases, handbooks and the respective references). For easier use the paper has been structured as follows: general information, cardiocirculatory system and ECG at altitude, several cardiocirculatory diseases and their specific recommendations. The commission concludes, that a general "don't go!" is no state-of-the-art advice for the patients. With the information presented here a safe trip to altitude should be possible for many patients.

Introduction

Rationale

Mountainous regions occupy 40 million km^2 and account for approximately 27% of the Earth's surface. It is estimated that 38 million people live permanently above 2500 m, with an additional 100 million visitors travelling to mountain regions for work and recreation each year [1]. A significant subpopulation of these visitors is older and carries along several risk factors for cardiopulmonary disease or suffer from such disease [2—7].

Mountains are inherently dangerous. Mountaineering activities are typically characterized by strenuous exercise in a particular environment where the combination of falling barometric pressure and consequent ambient hypoxia, temperature and humidity together with increases in solar radiation and wind speed may trigger a series of important physiological responses that affect principally the respiratory, cardiovascular, neuroendocrine and renal systems. These events can contribute to serious physical problems in subjects at risk [1]. The exact altitude at which these physiological changes affect cardiopulmonary performance varies between individuals, however significant changes typically begin at >2500 m.

Despite the challenges faced by falling barometric pressure, regular physical activity and exposure to moderate altitudes up to 2500 m under certain conditions may contribute to well-being and longevity [8,9].

Literature on whether people with pre-existing cardiovascular conditions should go to high altitude is limited. Making a decision depends upon what altitudes are likely to be encountered, activities chosen, the nature of the pre-existing disease and other factors such as the general medical condition of the subject. The Union Internationale des Associations d'Alpinisme (UIAA) is the world umbrella organization for health and safety at altitude. The medical commission (UIAA MedCom) focuses on preventive aspects of high altitude exposure. This includes the effects of hypoxia and exercise on humans with medical preconditions. In total the UIAA represents 57 countries worldwide with a total of about 80 organizations, 37 countries have joined the medical commission (for details see www.theuiaa.org/organization.html). The recommendations given by UIAA MedCom are based on a detailed intensive literature research, regularly updated and based on consensus from the entire commission. The literature research of the recommendation presented here was performed in international literature databases (e.g. PubMed, DIMDI etc.) with an extensive list of keywords (e.g. altitude, hypoxia, acute mountain sickness, high altitude diseases, high altitude pulmonary edema, several keywords for preexisting diseases, and many others). For older literature the reference list of the papers as well as the personal literature knowledge of the specialists were used. As there is a total of several hundreds of papers which are potentially of interest for the topic the consensus group had to select those which were considered to be most important for the actual recommendation. It must be pointed out that this is not a pure (patho-) physiological paper: the multitude and variability of influencing factors forces to categorise these factors and diagnoses. Otherwise the recommendation would be unmanageable. In fact, the evidence for most diagnoses is limited. However, with the relative conservative approach it should be possible to give the individual patient sufficient advice if and how he or she may go to a certain altitude or not and how he/she should react when problems should occur.

This paper deals with pre-existing cardiocirculatory diseases only. It does not mention cardiocirculatory diseases which are unknown, sudden, and that affect unforeseen a person during the trek.

Epidemiological data

Cardiovascular diseases (CVDs) are the commonest cause of death globally: more people die annually from CVDs than from any other cause. Mortality data for 2007 show that CVDs accounted for 33.6% of all deaths, or 1 in every 2.9 deaths in the United States [10,11].

CVDs are a group of disorders of the heart and blood vessels that include:

- coronary heart disease — disease of the blood vessels supplying the heart muscle
- cerebro-vascular disease — disease of the blood vessels supplying the brain
- valvular heart disease — damage to the heart valves from rheumatic fever, bacterial infection or degenerative processes (ischaemia, sclerosis, myxomatosis)
- congenital heart disease — malformations of heart structure existing at birth
- congestive heart failure — inability of the heart to supply sufficient blood flow to meet the body's needs by different causes

Heart attacks and strokes are usually acute events and are mainly caused by a blockage that prevents blood from flowing to the heart or brain. The most common reason for