

and prompt descent are the cornerstones of treatment of most of these neurologic conditions.

Psychological/Psychiatric Problems Delirium characterized by a sudden change in mental status, a short attention span, disorganized thinking, and an agitated state during the period of confusion has been well described in mountain climbers and trekkers without a prior history. In addition, anxiety attacks, often triggered at night by excessive periodic breathing, are well documented. The contribution of hypoxia to these conditions is unknown. Expedition medical kits need to include antipsychotic injectable drugs to control psychosis in patients in remote high-altitude locations.

PREEXISTING MEDICAL ISSUES

Because travel to high altitudes is increasingly popular, common conditions such as hypertension, coronary artery disease, and diabetes are more frequently encountered among high-altitude sojourners. This situation is of particular concern for the thousands of elderly pilgrims with medical problems who visit high-altitude sacred areas (e.g., in the Himalayas) each year. In recent years, high-altitude travel has attracted intrepid trekkers who are taking immunosuppressive medications (e.g., kidney transplant recipients or patients undergoing chemotherapy). Recommended vaccinations and other precautions (e.g., hand washing) may be especially important for this group. Although most of these medical conditions do not appear to influence susceptibility to altitude illness, they may be exacerbated by ascent to altitude, exertion in cold conditions, and hypoxemia. Advice regarding the advisability of high-altitude travel and the impact of high-altitude hypoxia on these preexisting conditions is becoming increasingly relevant, but there are no evidence-based guidelines. In addition, recommendations made for relatively low altitudes (~3000 m) may not hold true for higher altitudes (>4000 m), where hypoxic stress is greater. Personal risks and benefits must be clearly thought through before ascent.

Hypertension At high altitudes, enhanced sympathetic activity may lead to a transient rise in blood pressure. Occasionally, nonhypertensive, healthy, asymptomatic trekkers have pathologically high blood pressure at high altitude that rapidly normalizes without medicines on descent. Sojourners should continue to take their antihypertensive medications at high altitudes. Hypertensive patients are not more likely than others to develop altitude illness. Because the probable mechanism of high-altitude hypertension is α -adrenergic activity, anti- α -adrenergic drugs like prazosin have been suggested for symptomatic patients and those with labile hypertension. It is best to start taking the drug several weeks before the trip and to carry a sphygmomanometer if a trekker has labile hypertension. Sustained-release nifedipine may also be useful. For a common problem like hypertension, there is clearly inadequate knowledge on which to base appropriate recommendations.

Coronary Artery Disease Myocardial oxygen demand and maximal heart rate are reduced at high altitudes because the VO_2 max (maximal oxygen consumption) decreases with increasing altitude. This effect may explain why signs of cardiac ischemia or dysfunction usually are not seen in healthy persons at high altitudes. Asymptomatic, fit individuals with no risk factors need not undergo any tests for coronary artery disease before ascent. For persons with ischemic heart disease, previous myocardial infarction, angioplasty, and/or bypass surgery, an exercise treadmill test is indicated. A strongly positive treadmill test is a contraindication for high-altitude trips. Patients with poorly controlled arrhythmias should avoid high-altitude travel, but patients with arrhythmias that are well controlled with antiarrhythmic medications do not seem to be at increased risk. Sudden cardiac deaths are not noted with a greater frequency in the Alps than at lower altitudes; although sudden cardiac deaths are encountered every trekking season in the higher Himalayan range, accurate documentation is lacking.

Asthma Although cold air and exercise may provoke acute bronchoconstriction, asthmatic patients usually have fewer problems at high than at low altitudes, possibly because of decreased allergen levels and increased circulating catecholamine levels. Nevertheless, asthmatic individuals should carry all their medications, including oral

glucocorticoids, with proper instructions for use in case of an exacerbation. Severely asthmatic persons should be cautioned against ascending to high altitudes.

Pregnancy In general, low-risk pregnant women ascending to 3000 m are not at special risk except for the relative unavailability of medical care in many high-altitude locations, especially in developing countries. Despite the lack of firm data on this point, venturing higher than 3000 m to altitudes at which oxygen saturation drops steeply seems unadvisable for pregnant women.

Obesity Although living at a high altitude has been suggested as a means of controlling obesity, obesity has also been reported to be a risk factor for AMS, probably because nocturnal hypoxemia is more pronounced in obese individuals. Hypoxemia may also lead to greater pulmonary hypertension, thus possibly predisposing the trekker to HAPE.

Sickle Cell Disease High altitude is one of the rare environmental exposures that occasionally provokes a crisis in persons with the sickle cell trait. Even when traversing mountain passes as low as 2500 m, people with sickle cell disease have been known to have a vasoocclusive crisis. Sickle cell disease needs to be considered when persons traveling to high altitudes become unwell and develop left-upper-quadrant pain. Patients with known sickle cell disease who need to travel to high altitudes should use supplemental oxygen and travel with caution.

Diabetes Mellitus Trekking at high altitudes may enhance sugar uptake. Thus, high-altitude travel may not pose problems for persons with diabetes that is well controlled with oral hypoglycemic agents. An eye examination before travel may be useful. Patients taking insulin may require lower doses on trekking/climbing days than on rest days. Because of these variations, diabetic patients need to carry a reliable glucometer and use fast-acting insulin. Ready access to sweets is also essential. It is important for companions of diabetic trekkers to be fully aware of potential problems like hypoglycemia.

Chronic Lung Disease Depending on disease severity and access to medical care, preexisting lung disease may not always preclude high-altitude travel. A proper pretravel evaluation must be conducted. Supplemental oxygen may be required if the predicted PaO_2 for the altitude is <50–55 mmHg. Preexisting pulmonary hypertension may also need to be assessed in these patients. If the result is positive, patients should be discouraged from ascending to high altitudes; if such travel is necessary, treatment with sustained-release nifedipine (20 mg twice a day) should be considered. Small-scale studies have revealed that when patients with bullous disease reach ~5000 m, bullous expansion and pneumothorax are not noted. Compared with information on chronic obstructive pulmonary disease, fewer data exist about the safety of travel to high altitude for people with pulmonary fibrosis, but acute exacerbation of pulmonary fibrosis has been seen at high altitude. A handheld pulse oximeter can be useful to check for oxygen saturation.

Chronic Kidney Disease Patients with chronic kidney disease can tolerate short-term stays at high altitudes, but theoretical concern persists about progression to end-stage renal disease. Acetazolamide, the drug most commonly used for altitude sickness, should be avoided by anyone with preexisting metabolic acidosis, which can be exacerbated by this drug. In addition, the acetazolamide dosage should be adjusted when the glomerular filtration rate falls below 50 mL/min, and the drug should not be used at all if this value falls below 10 mL/min.

CHRONIC MOUNTAIN SICKNESS AND HIGH-ALTITUDE PULMONARY HYPERTENSION

Chronic mountain sickness (*Monge's disease*) is a disease of long-term residents of altitudes above 2500 m that is characterized by excessive erythrocytosis with moderate to severe pulmonary hypertension leading to cor pulmonale. This condition was originally described in South America and has also been documented in Colorado and in the Han Chinese population in Tibet. Migration to a low altitude results in the resolution of chronic mountain illness. Venesection and acetazolamide are helpful.