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ALTITUDE ILLNESS

Altitude illness occurs when a person ascends more rapidly than the body can adjust ("acclimatize") to the decreased oxygen at a higher altitude. Some people adjust very easily, while others cannot go above even moderate heights without experiencing symptoms. There is no way to know ahead of time whether one will be a good acclimatizer, except based on past experience. If symptoms occurred before, it is likely they may occur again at the same altitude. The ability to acclimatize may be genetic.

Altitude illness falls into 3 categories: acute mountain sickness (AMS), high altitude pulmonary edema (HAPE), and high altitude cerebral edema (HACE). Symptoms can range from mild to life-threatening, but most symptoms can be prevented or minimized by proper acclimatization and/or preventive medications. Prevention strategies will vary depending on the type of travel planned: travel to typical tourist destinations at relatively moderate heights or trekking in extreme high altitude situations.

AMS: AMS symptoms include headache (which can be mild to extremely painful), loss of appetite (which can progress to nausea and vomiting), and extreme fatigue.

HACE: HACE begins like AMS but the symptoms become more severe, including changes in consciousness and loss of coordination; HACE can progress rapidly to coma and death. HACE can occur alone or in combination with HAPE.

HAPE: HAPE symptoms include unusual breathlessness upon exertion and, eventually, even while at rest. Cough is usually present (although cough at high altitude is common from other causes). The trekker may feel fullness in the chest. Descent is mandatory as soon as HAPE is suspected, because the symptoms can progress rapidly and death can occur within hours. Unfortunately, exertion considerably worsens HAPE, so exertion by the sick person should be minimized during descent, if at all possible.

Other Conditions: Periodic breathing can occur in persons sleeping above 3,000 m (9.800 ft). While sleeping, increasingly deep breaths are followed by a brief (5-30 seconds) period of not breathing. If periodic breathing at altitude is disturbing to the trekker, acetazolamide 125 mg taken before bed can relieve the problem.

Peripheral edema (swelling of the face, hands, and feet) can occur. Although harmless by itself, edema indicates poor acclimatization that can lead to other symptoms of altitude illness. As persons with peripheral edema begin to acclimatize, they often experience a profound diuresis (increased urine flow) and relief of symptoms. Trekkers should not ascend if other symptoms develop.

Risk by Type of Travel

At **typical tourist destinations** (e.g., at altitudes of around 3,000 m or 9,800 ft), mild symptoms can occur but the severe forms of AMS (HAPE or HACE) rarely occur. Most mountain resorts are located at these lower altitudes (ranging from, 1,200 to 3,000 m; 3,900 to 9,800 ft). Travelers may go higher during daytime activities (e.g., skiing, hiking, sightseeing) but risk is lessened by descending again, to sleep at the resort altitude. There is more risk for the traveler who hikes vigorously or flies directly to higher destinations, because these modes do not allow for gradual acclimatization. Examples of destinations that allow access, without hiking, to relatively high altitudes include: La Paz, Bolivia; Lhasa, Tibet; and Cuzco, Peru.

High Altitude Trekkers are at higher risk of HAPE and HACE.

- Altitude illness affects 50% or more trekkers on popular high-altitude routes.
- There are 2-3 trekker deaths a year from complications of altitude sickness in Nepal.
- The risk of dying from altitude sickness in the Himalaya is also higher, even though the trek allows one to acclimatize gradually; this is because the trekker is at high altitude for longer periods of time.
- Most trekking itineraries take a "one-size fits all" approach towards the pace of the trek, and thus cannot guarantee that altitude illness will not occur.
- Trekking agencies feel pressure to offer shorter expeditions for busy people who cannot take long holidays. For example, Mount Kilimanjaro treks that summit in 5 days are offered when even a 7-day ascent offers altitude gains that are more rapid than typical Himalaya treks.

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PREVENTION Trekkers and tourists should:

- Ascend gradually.
  - This allows time to acclimatize.
  - Do not ascend directly to altitudes higher than 3,000 m (9,800 ft), if possible.
  - If an abrupt ascent is unavoidable (e.g., flying directly to the destination), acetazolamide might be needed.
- Return to a lower altitude to sleep.
  - If participating in activities at altitudes higher than 3,000 m (9,800 ft) during the day, return to a lower altitude to sleep. Many mountain resorts are purposely located at lower altitudes (1,200 to 3,000 m; 4,000-10,000 ft).
  - For example: Travelers typically stay in Mammoth Lakes, California (2,400 m; 7,900 ft) or nearby areas and ski at the higher altitudes of the mountain.
- Ascend no more than 500 m per day (1,600 ft per day).
  - Once the traveler is at an altitude of 3,000 m (10,000 ft), he or she should ascend no higher the 500 m (1,600 ft) each day to sleep.
- Avoid alcohol and only participate in mild exercise for the first 48 hours.
- It is important that the traveler learn to recognize symptoms of altitude illness in the event they occur.
  - Deaths from altitude illness almost invariably result because symptoms were ignored or not recognized.
- Never ascend to sleep at a higher altitude with any symptoms of altitude illness.

- "Climb high, sleep low."
  - Climbers who reach higher altitudes during the day should return to the valleys to sleep.
- If possible, have a high altitude exposure (higher than 3,000 m; 9,800 ft) for 2 or more nights sometime within 30 days before a trek.
- Note that in organized trekking groups, there is a great deal of pressure to keep up with the group schedule. If symptoms occur, do not allow group pressure to decide what actions to take.

Acetazolamide (Diamox)

- For prevention of AMS: Start taking the drug the day before ascending, take each day during ascent, and continue to take for 24-48 hours after arrival at highest altitude.
  - Adult dose: 125 mg every 12 hours
  - Pediatric dose: 2.5 mg/kg/dose every 12 hours
- Precautions:
  - Persons with multiple drug allergies or a history of a life-threatening reaction to sulfa drugs should have acetazolamide administered in a controlled environment before the trip.
  - Persons with a history of mild sulfa reactions or rashes can take acetazolamide safely.
- Side effects:
  - Almost always causes numbness of fingers and toes, and occasionally oral
  - Occasionally causes nausea

Ibuprofen (Advil, Motrin)

- For prevention of headache: 600 mg every 8 hours, starting a few hours before ascent.
- Side effects: gastrointestinal irritation and bleeding.

TREATMENT: Descent should always be the first option, whether a tourist or trekker. Oxygen is helpful for both categories of traveler. Pressurization bags are used only for trekkers. Other medications are available under medical supervision.

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