Altitude Sickness (Acute Mountain Sickness) - AMS

Altitude sickness is an illness seen in people who have recently arrived at high altitude or have recently gained significant altitude. It is caused by the body’s attempt to compensate for the lower levels of oxygen in the blood that occur at higher altitude.

About 25% of travellers who live at sea level will experience altitude sickness when visiting destinations at elevations between 2000 and 3000 metres. Above 3300 metres (10,000 feet), about 50% of travellers are affected.

**Symptoms** of early altitude sickness include:
- Headache, nausea, vomiting, loss of appetite, difficulty breathing, feeling tired, mood changes, dizziness and insomnia.

Two serious forms of altitude sickness may also occur at elevations higher than 3000m, but have been reported at lower altitudes. The risk depends on how fast one climbs, how high one gets (especially sleeping altitude) and on how vulnerable one might be to altitude sickness. Both forms can occur at once:
- **High Altitude Cerebral Edema (HACE):** which is swelling of the brain, occurs in 0.5 – 1% of all individuals travelling at altitude, but increases with extreme elevation, reaching 2-3% when scaling mountains to about 6000m. Symptoms include changes in mental status (one’s ability to think properly) and/or decreased control of muscles or not feeling coordinated. Extreme symptoms of AMS are usually present (e.g. severe headache, severe vomiting, lassitude, extreme fatigue)
- **High Altitude Pulmonary Edema (HAPE):** is where fluid collects in the lungs (water-clogged lungs), and usually occurs around 2-5 days at higher altitudes. Early symptoms include shortness of breath on exertion and a dry cough. Late symptoms include shortness of breath at rest and coughing up pink or blood tinged sputum (spits). Like HACE, the risk of HAPE goes up with increasing altitude and occurs in 1 in 10,000 visitors to modest altitudes (about 3000m) up to 2% of people climbing up to 6000m.

*HACE and HAPE are both medical emergencies. Immediate and rapid descent is essential.*

**Prevention:**
The most effective preventative measure is acclimatization by a two to three day stay at intermediate altitude (2500 - 3000 metres), and gradual ascent to higher elevations. Alcohol and sleeping pills should be avoided. It is better to return to a lower altitude to sleep (climb high - sleep low).

**Medication: Acetazolamide (e.g. Diamox®):**
Although not licensed for this purpose in Canada, acetazolamide can be used for the prevention of acute altitude sickness. It can speed up the adjustment to altitude, can reduce the risk of AMS and HACE, and can shorten how long one will have altitude sickness. Very few travellers will need this medication, but it may be considered for travellers:
- who do not have time to acclimatize e.g. emergency rescue workers
- with a rapid ascent (less than or equal to 1 day) to altitudes greater than 3000 metres
- with a rapid gain in sleeping altitude (e.g. moving camp from 4000 to 5000 metres in one day)
- with a history of AMS or HACE, with rapid ascent to altitudes greater than 2500 metres
- with a history of HAPE (*Refer to a travel medicine specialist, as alternate medication may be indicated; See APPENDIX 1 Prescription Referral Form from Primary HCP to Specialized TH Clinic")

October 29, 2019
Refer to a Physician, Nurse Practitioner or Prescriber for a Prescription for the Prevention of Acute Mountain Sickness:
The most effective dose of acetazolamide for adults (or individuals greater than 50 kg) is 250 mg (one tablet) twice a day for the prevention of acute mountain sickness. Travellers should be counselled to decrease their dosage to ½ tablet (125 mg) orally twice daily, if severe tingling develops in hands or feet.

There are two principal scenarios with high altitude areas in the world (with altitudes over 3000 metres) where there would be an indication for the use of acetazolamide for the prevention of acute mountain sickness. Examples are:

1) Treks in the Andes of South America, involving Cusco (Peru) or La Paz (Bolivia). Prescriptions should be provided as follows:
   - Start 24 hours before accent and continue for 2 more days at altitude (for a total of 3 days of acetazolamide)
   - Full acclimatization should occur after spending 2 days at altitude
2) Higher elevation treks to Mt. Kilimanjaro (Tanzania), Mt. Kenya (Kenya), the Himalayas or Everest Base Camp (Nepal). Prescriptions should be provided as follows:
   - Start 24 hours before accent and take daily until highest altitude is reached
   - The timeframe for ascent can extend beyond the typical 3 days, as in the first scenario. When trekking to these higher altitudes, one may therefore need a longer course of acetazolamide.
   - Continue acetazolamide for two days after reaching the highest altitude (ie; if staying at Everest Base Camp) or stop taking acetazolamide on the day of descent, whichever comes first.

There can be many variations in ascents, involving much more complex itineraries with long mountain treks up to extreme altitudes (above 4000 metres) or comprising multiple ascents and descents over a period of several weeks. For these types of treks, you should refer to a travel medicine specialist. Many extreme altitudes (especially those over 5000 metres) may require different medications, that are beyond the scope of the general provider (See APPENDIX 1, Prescription Referral Form from Primary HCP to Specialized TH Clinic).

Common Side Effects:

- Numbness or tingling in hands and feet, passing more urine than usual, nausea, feeling tired, slightly blurred vision when looking at close objects (e.g. reading) and inability to properly taste carbonated beverages (including beer and soft drinks).
- To prevent a rare problem with the kidneys while taking this medication, it is important to drink lots of fluids.

Allergy to Sulfa Drugs:

- Acetazolamide is related to sulfa drugs, and had previously been considered contraindicated in persons known to be allergic to sulfa drugs. More recently, this recommendation has been challenged as it does not appear that sulfa allergy predicts allergic reactions to acetazolamide. Acetazolamide should therefore not be withheld from sulfa-allergic individuals:
  - Acetazolamide is a non-antibiotic sulfonamide drug. Due to different chemical structures, no cross-reactivity occurs between sulfonamide antibiotics and non-antibiotics.
  - Persons with an isolated allergy to sulfonamide antibiotics have no increased risk of an allergic reaction when taking acetazolamide.
Risk of an allergic reaction to acetazolamide may be increased in people with multiple drug allergies or with allergies to multiple antibiotics.

Individuals with a history of life-threatening reactions to sulfa drugs or multiple drug allergies should have a test dose of acetazolamide administered in a controlled environment at home before their trip. Those with a history of mild sulfa reactions or rashes can safely take acetazolamide.

Young Children and Altitude:

- Infants may be at greater risk of adverse events at altitude. Young children can be defined as those less than 8 years of age. The following comprehensive reference, suggests that children over about 8 years of age can usually express symptoms of AMS adequately, and have no added risk of AMS compared to adults: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.534.6650&rep=rep1&type=pdf
- The signs of AMS (nausea, vomiting, and irritability) are very non-specific in infants and young children, and could be mistaken for other conditions. Given the rapidity with which infants and young children can deteriorate and the limitations in being able to assess them, experts recommend not to ascend higher than 2500m for infants and to use caution with young children.
- Children are extremely sensitive to hypoxia, as expressed by symptoms of AMS and significant desaturation. It is therefore very important to closely monitor young children during ascent to high altitude and to ascend no more than 300 metres a day above 2,500 metres with a rest day every 1000 metres.
- Children with medical conditions that increased their risk of hypoxia–related problems should probably avoid high altitude.
- Published data are limited, but most experts agree that pediatric doses of acetazolamide (2.5 mg/kg bid) can be considered for unavoidable ascents to higher altitudes; however you should refer to a travel medicine specialist (See APPENDIX 1, Prescription Referral Form from Primary HCP to Specialized TH Clinic).

Treatment:

- **Stop climbing:** with rest and some time at the same altitude, one can usually adjust to the altitude in 12 hours to 4 days.
- **Descend:** this is the treatment of choice; if symptoms do not improve or they worsen with some rest and time at the same altitude, go down immediately. Going down to an altitude at least 500 metres lower than where altitude sickness was identified, usually reverses the symptoms.
- Take adequate fluids (to compensate for hyperventilation, perspiration, exertion)
- Maintain an adequate caloric intake (diet low in proteins, fats, salts)
- Analgesics like ibuprofen (single 400 mg oral dose) may reduce the severity of high-altitude headaches, while acetaminophen may be helpful to treat mild headaches
- Oxygen may be needed

Sources:
CATMAT Statement on High Altitude Illnesses, April 1, 2007
CATMAT Statement on Pediatric Travellers, June 2010
AMS Referral Form for Primary HCP to Specialized TH Clinic:
For the Prevention of Altitude Sickness or Acute Mountain Sickness (AMS)

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<th>□ Adult Referral: WRHA Travel Health &amp; Tropical Medicine Services</th>
<th>□ Pediatric Referral: Children’s Hospital, Infectious Diseases</th>
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<tr>
<td>Fax #: 204-940-8409</td>
<td>Fax #: 204-272-3095</td>
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<tr>
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<td>Address with Postal Code</td>
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<tr>
<td>PHIN</td>
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I saw the above named individual in my clinic and am referring him/her to a specialized clinic for a prescription for the prevention of altitude sickness or acute mountain sickness (AMS).

**Reason for Referral (Click all that Apply):**

- □ History of high altitude pulmonary edema (HAPE)
- □ Complex itinerary
- □ Multiple ascents and descents
- □ Extreme altitudes over 4000 metres
- □ Complex medical problems (ie; heart or lung disease, moderate to severe asthma, moderate to severe COPD, ischemic heart disease, peripheral vascular diseases etc)
- □ Pediatric traveller to high altitude areas
- □ Other: _______________________________________________________________________________  

**The following information is required:**

- □ Itinerary: ________________________________________________________________________________

- □ Date of Departure: _____________________________

October 29, 2019
Background Information for Primary Health Care Provider

Altitude Sickness or Acute Mountain Sickness (AMS):

- About 25% of people will develop symptoms of AMS when visiting places between 2000 and 3000 metres (6,700 and 10,000 feet) above sea level.
- About 50% of people will develop symptoms of AMS above 3300 metres (10,000 feet).
- At altitudes above 3660 metres (about 12,000 feet) more serious forms of altitude sickness such as high altitude pulmonary edema (HAPE) and high altitude cerebral edema (HACE) can occur. These are medical emergencies. The treatment is immediate rapid descent to a lower altitude and receiving medical care.

Preventative Medication:
Acetazolamide (e.g. Diamox®), although not licensed for this purpose in Canada, but strongly recommended by the Public Health Agency of Canada (see CATMAT Statement on High Altitude Sickness), can be used for the prevention of altitude sickness. It can speed up acclimatization to altitude. Very few travellers will need this medication, but it may be considered for travellers:

- who do not have time to acclimatize e.g. emergency rescue workers
- with a rapid ascent (1 day or less) to altitudes greater than 3000 metres
- with a rapid gain in sleeping altitude (e.g. moving camp from 4000 to 5000 metres in one day)
- with a history of AMS or HACE, with rapid ascent to altitudes greater than 2500 metres
- with a history of HAPE (*refer to a travel medicine specialist, as alternate medication may be indicated)

Dosage of Acetazolamide:

- The most effective dose of acetazolamide for adults (or individuals greater than 50 kg) is **250 mg (one tablet) twice a day** for the prevention of AMS
- Travellers should be counselled to decrease their dosage to ½ tablet (125 mg) orally twice daily, if severe numbness or tingling develops in hands or feet
- Length of prescription is dependent on individual itinerary and requires a full altitude risk assessment
- A common itinerary involving travel to Cusco (Peru) or La Paz (Bolivia) would be as follows:
  - Start 24 hours before accent and continue for 2 more days at altitude (for a total of 3 days of acetazolamide)
  - Full acclimatization should occur after spending 2 days at altitude
- There can be many variations in ascents, involving much more complex itineraries with long mountain treks up to extreme altitudes (above 4000 metres) or comprising multiple ascents and descents over a period of several weeks. For these types of treks, you should refer to a travel medicine specialist. Many extreme altitudes (especially those over 5000 metres) may require different medications, that are beyond the scope of the general provider.
- Published data are limited, but most experts agree that pediatric doses of acetazolamide (2.5 mg/kg twice daily) can be considered in children for unavoidable ascents to higher altitudes; however you should refer to a travel medicine specialist.

Common Side Effects:

- Numbness or tingling in hands and/or feet due to a reversible peripheral neuropathy; passing more urine than usual due to diuretic effect; nausea; feeling tired; slightly blurred vision when looking at close objects (ie; reading); inability to properly taste carbonated beverages (including beer and soft drinks).

Allergy to Sulfa Drugs:

- Acetazolamide is related to sulfa drugs, and had previously been considered contraindicated in persons known to be allergic to sulfa drugs. More recently, this recommendation has been challenged as it does not appear that sulfa allergy predicts allergic reactions to acetazolamide.

References:

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