

Case Presentations

Advanced Mountain Medicine for Guides
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REVIEW ARTICLE

Wilderness Medical Society Consensus Guidelines for the Prevention and Treatment of Acute Altitude Illness

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High Altitude Illness Case

- A 30 year old climber presents to the 14,000 ft. medical camp on Denali with severe headache, insomnia, poor appetite, and nausea. Oxygen saturation is 84% breathing ambient air (normal), lungs are clear to auscultation, no SOB, and neuro exam is normal. What is the problem and what do you recommend?



AMS Rx: considerations

- Logistics
 - Terrain, weather, time of day, available help
- Severity
 - Severe more urgent
- Expertise
- Rx availability
 - Medical kit, oxygen. etc



Treatment options for AMS

- **Halt ascent**; acclimatize further
- **Descent** (>300 m, whatever necessary)
- **Oxygen** (low flow to conserve)
- **Hyperbaric bag** (Min 2 hrs, 4-6 ideal)
- **Symptomatic meds**: ibuprofen, ondansetron
- **Acetazolamide**
- **Dexamethasone** (incredibly effective)
- **Combinations of above**



AMS Treatment

WMS High Altitude Illness Guidelines

- Halt ascent; consider descent, but often not necessary
 - Descend if symptoms progress suggesting HACE or HAPE
 - Analgesics for headache (ibuprofen 600mg or acetaminophen 500mg), and anti-emetics for nausea
 - Speed acclimatization: Diamox 250mg twice a day
 - Dexamethasone for severe AMS
- 

Case : Severe Altitude Illness

The climber with AMS at 14,000 ft. on Denali climbs to the 17,000 ft. camp. He develops ataxia and confusion during the night. What is the diagnosis?

1. Severe AMS
2. HACE and HAPE
3. HACE
4. HAPE



Climber at 17,000 ft. with HACE, what is the treatment?

1. Descent
2. Dexamethasone
3. Supplemental oxygen
4. Pressure bag
5. Elevate the head
6. All of the above



Case #10

- 27 y o male physician, Himalayan novice
- 2700 m to 5500 m in 6 days
- 3 days progressive sx: headache, insomnia, fatigue, anorexia, SOB, cough, ataxia
- Tried to descend, collapsed; carried back to basecamp
- Next AM in coma











Prevention of AMS/HACE

- Goal is to prevent mod/severe AMS
 - Mild AMS may be unavoidable
 - Mild AMS is manageable
 - Maintain functional capacity
 - Preventing AMS& HAPE prevents HACE
- In 2013, no one should die of AMS/HACE



Prophylaxis of AMS/HACE

- Necessity based on risk assessment
 - As with malaria, sea-sickness, etc
- Goal is to minimize illness
- Prevention of AMS/HACE is NOT performance enhancing in sporting sense



Prevention of severe altitude illness: Three Steps

Risk evaluation

Plan for prevention or amelioration

Monitoring, early recognition and treatment



Island Peak ascent profile



Climb Profile for Machame Trial

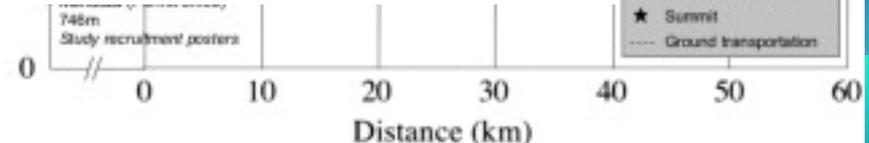
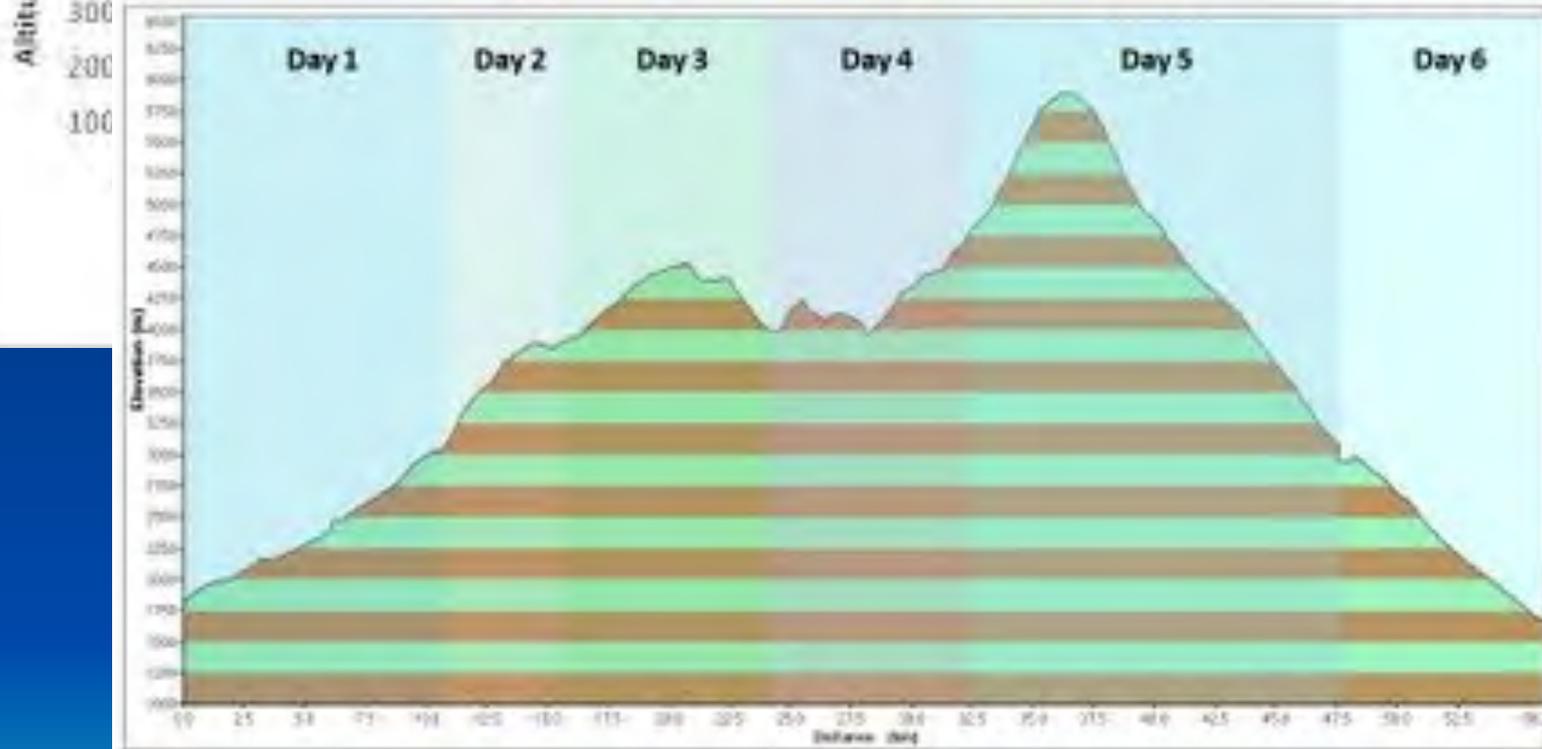


Table 3. Risk Categories for Acute Mountain Sickness

Risk Category	Description
Low	<ul style="list-style-type: none">• Individuals with no prior history of altitude illness and ascending to ≤ 2800 m;• Individuals taking ≥ 2 days to arrive at 2500-3000 m with subsequent increases in sleeping elevation < 500 m/day and an extra day for acclimatization every 1000 m
Moderate	<ul style="list-style-type: none">• Individuals with prior history of AMS and ascending to 2500-2800 m in 1 day• No history of AMS and ascending to > 2800 m in 1 day• All individuals ascending > 500 m/day (increase in sleeping elevation) at altitudes above 3000 m but with an extra day for acclimatization every 1000 m
High	<ul style="list-style-type: none">• History of AMS and ascending to ≥ 2800 m in 1 day• All individuals with a prior history of HAPE or HACE• All individuals ascending to > 3500 m in 1 day• All individuals ascending > 500 m/day (increase in sleeping elevation) above > 3000 m without extra days for acclimatization• Very rapid ascents (eg. < 7 day ascents of Mt. Kilimanjaro)

AMS: Acute mountain sickness; HACE: High altitude cerebral edema; HAPE: High altitude pulmonary edema

Notes:

- Altitudes listed in the table refer to the altitude at which the person sleeps
- Ascent is assumed to start from elevations < 1200 m
- The risk categories described above pertain to unacclimatized individuals

Prevention Plan

- Based on altitude, especially sleeping altitude
- **Rate of ascent, ascent profile**
- Past history
- Use of medication, usually Diamox

- Then monitoring, early recognition and treatment



WMS Consensus Guidelines for the Prevention and Treatment of Acute Altitude Illness (Wilderness and Environmental Medicine 2010)

Table 2. Recommended dosages for medications used in the prevention and treatment of altitude illness

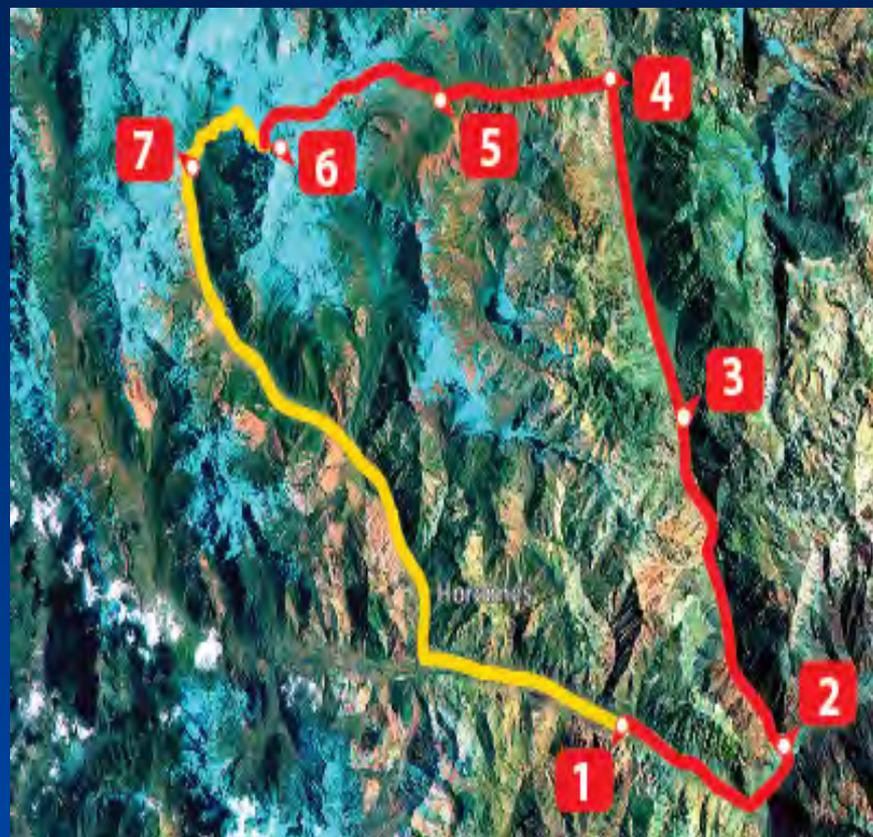
<i>Medication</i>	<i>Indication</i>	<i>Route</i>	<i>Dosage</i>
Acetazolamide	AMS, HACE prevention	Oral	125 mg twice per day Pediatrics: 2.5 mg/kg every 12 h
	AMS treatment ^a	Oral	250 mg twice per day Pediatrics: 2.5 mg/kg every 12 h
Dexamethasone	AMS, HACE prevention	Oral	2 mg every 6 h or 4 mg every 12 h Pediatrics: should not be used for prophylaxis
	AMS, HACE treatment	Oral, IV, IM	AMS: 4 mg every 6 h HACE: 8 mg once then 4 mg every 6 h Pediatrics: 0.15 mg/kg/dose every 6 h
Nifedipine	HAPE prevention	Oral	30 mg SR version, every 12 hours or 20 mg of SR version every 8 h
	HAPE treatment	Oral	30 mg SR version, every 12 hours or 20 mg of SR version every 8 h
Tadalafil	HAPE prevention	Oral	10 mg twice per day
Sildenafil	HAPE prevention	Oral	50 mg every 8 h
Salmeterol	HAPE prevention	Inhaled	125 μ g twice per day ^b

Monitoring Clients on Aconcagua



Despite good risk assessment and good management plan, recommended rate of ascent, etc.: bad things happen.

Monitoring and early recognition of altitude problems is a critical skill for guides



- 1** Penitentes (2700 mts)
- 2** Punta de Vacas (2700 mts)
- 3** Pampa de Leñas (2950 mts)
- 4** Casa de Piedras (3240 mts)
- 5** Plaza Argentina (4200 mts)
- 5A** Camp 1 (5000 mts)
- 5B** Camp 2 (5500 mts)
- 5C** Camp 3 (6000 mts)
- 6** Summit (6962 mts)

ACONCAGUA

High Altitude Field Kit

- **Pulse Oximeter**
- Stethoscope
- Meds
- **Notepad & Pencil**



	Penitentes 2700m/ 8,858ft	Llenas 2950m/ 9,678ft	Casa Pedras 3240m/ 10,629ft	Plaza Argentina 4200m/13,779ft	Plaza Argentina 4200m/ 13,779ft	
1	98/75 – OK	98/69 - Cold	93/81 – Tired	96/79 – Rested	90/82 – Resting	
2	90/95 – Not Good	88/100 – Nervous	85/120 – Crappy	81/98 – Stressed	81/86 - Restless	
3	95/86 - Anxious	*84/125 – 94/80 No Sleep	89/81 – Restless night	77/98 – Restless, racing heart	*62/120 – Lying flat *83/89 – Sitting up at rest	7am - 90/89 O ₂ 3l/min
4	93/94 - Great	95/79 – Good	91/92 – Headache	82/88 – Slept well (10 hrs.)	83/65 – Resting	
5	96/75 – Very Good	98/70 – Very Good	94/80 - Good	92/79 – OK	92/76 – Resting	
		*Hands get cold, No pulse in			*5am crackles 8am heli	

Lake Louise Score

Mild AMS = 2-5 points
Moderate AMS = 6-10
Severe AMS = 11-15

Headache is required!

Symptom Score		
1.	Headache	<i>Score</i>
	No Headache - 0	
	Mild Headache - 1	
	Moderate Headache - 2	
	Severe, Incapacitating Headache - 3	
2.	Gastrointestinal Symptoms	<i>Score</i>
	No Symptoms - 0	
	Poor appetite or nausea - 1	
	Moderate nausea or vomiting - 2	
	Severe nausea and vomiting, incapacitating - 3	
3.	Fatigue/Weakness	<i>Score</i>
	Not tired or weak at all - 0	
	Mild fatigue or weakness - 1	
	Moderate fatigue or weakness - 2	
	Severe fatigue or weakness, incapacitating - 3	
4.	Dizzy/Lightheadedness	<i>Score</i>
	No dizziness/lightheadedness - 0	
	Mild dizziness/lightheadedness - 1	
	Moderate dizziness/lightheadedness - 2	
	Severely lightheaded, fainting/passing out - 3	
5.	Difficulty Sleeping	<i>Score</i>
	Slept well - 0	
	Did not sleep as well as usual - 1	
	Woke many times, poor night's sleep - 2	
	Could not sleep at all - 3	
Total Symptom Score:		

Case 1- a jealous husband

from Alison Sheets

- Guide and porters brought a patient for altered mental status.
- A healthy 6'2" Kiwi on a group trek with his wife.
- Gokyo(4750m) 2 nights ago, went over Cho La pass (5420m) and spent last night at Dzongla (4840m; 15,875 ft).
- Strong going over the pass but that night at Dzongla became irritable. The guide said he even accused him of flirting with his wife and telling secrets.
- Next day he was better on descent but going up towards Lobuche (4928m; 16,160 ft), he developed headache, nausea, fatigue. Assisted down to Pheriche (4340m).



At the clinic

- Patient c/o headache, nausea, weakness, withdrawn but able to answer questions and follow commands.
- VS: 153/76, HR 107, RR 20, 82% O₂sat (nl 85-88)
- Exam normal except for slowed responses and ataxic gait. Pale
- Treatment: O₂, dexamethasone, helicopter evacuation next morning to Kathmandu.





Lessons learned

- HACE is less common than HAPE and can occur without previous illness. Subtle mental status changes must be noted and acted on. Changes in personality, irritability, and ataxia are early signs of increased intracranial pressure. Know your clients, check vital signs, descend if unsure.
- This patient had AMS, got better with descent, then went higher and got worse; he should have stayed lower.



Case 2- the Retreat

- Polish climbers escort a team member to the clinic; climbing Cholatse (6335m)
- They acclimatized using standard guidelines.
- The day before they had climbed above 5000m but he was going too slow and could not continue.



Ataxia, mild





At the clinic

- Exam: as you see.
- Treatment: Oxygen overnight, dexamethasone, acetazolamide.
- Patient was able to descend with his group the next morning with hopes of returning for another attempt on Cholatse if acclimatization improved. We recommended a conservative approach...



Lessons Learned

- HAPE and HACE can occur even with slow ascents to altitude. Patients may not feel too sick or may minimize their symptoms, especially if very fit. This group noticed their partner's early decline and were able to get him down under his own power. Check for ataxia with heel toe walking.





Case 3- A hard worker

- A 42 year old Nepali porter is carried to the clinic late at night. His friends carried him nearly all the way from Gorak Shep (5160m).
- He has worked many seasons in the Khumbu without prior altitude problems.
- He became short of breath about 2 days ago and had deteriorated despite descending from Everest Base Camp (5545m) the day before.









Lessons learned

- Extremely low oxygen saturations are survivable. Oxygen, Gamow bag save lives.
- HAPE is the most common cause of altitude related deaths. It can occur in anyone despite prior altitude experience. Early recognition is key to good outcomes. Descent, O₂ are most vital treatments.
- This patient was discharged from the hospital in Kathmandu hours after his arrival. Last seen trying to get a ride back to the high country...



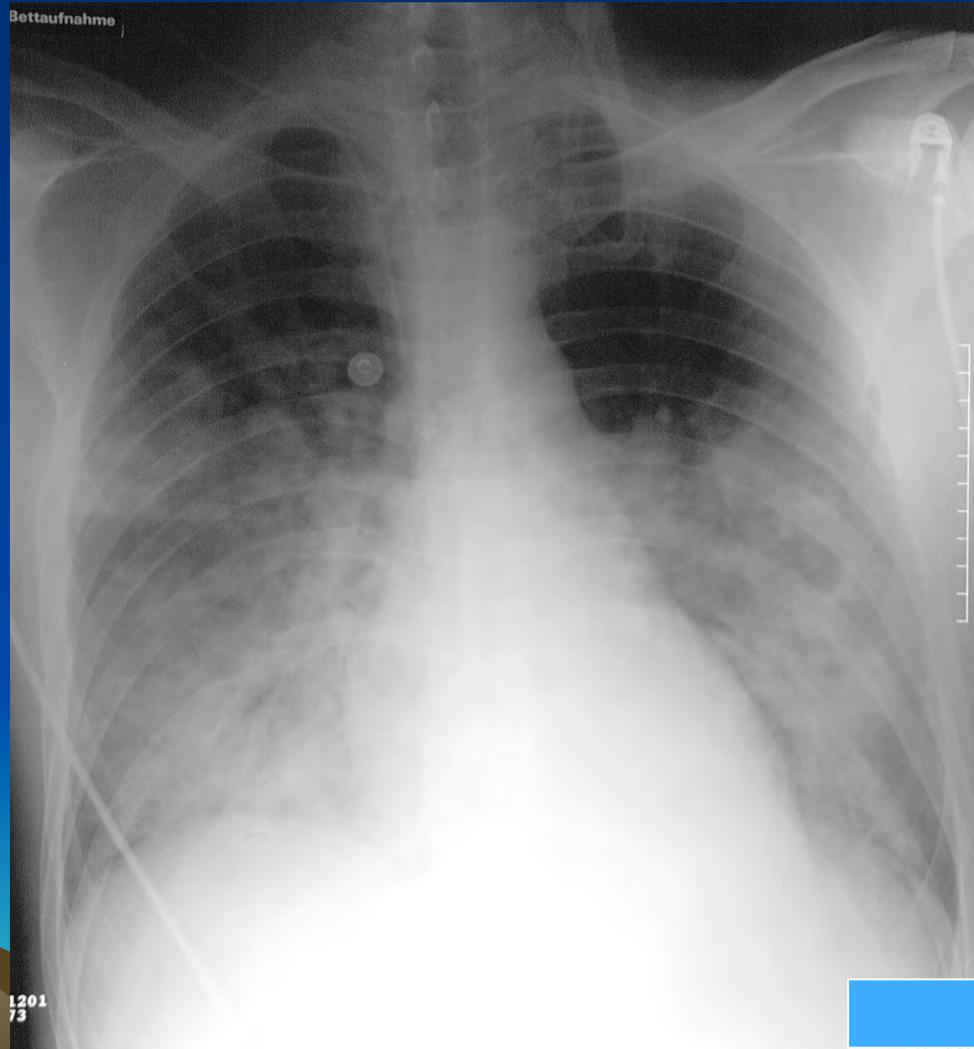
B.R., male 30 years old

- History

- During skiing between 2000 and 3000 m developed an "infection" of the upper airways with dry cough.
- Three days later at 2500m (8000ft) he developed productive cough with yellow secretion and rapidly progressive dyspnea (shortness of breath). The guide measured temperature of 39.2 °C (102.5° F).
- HR 118, RR 30, SpO2 66%
- The patient deteriorated rapidly and he was evacuated by helicopter.



B.R., male 30 years old



B.R. - HAPE or Infection?

- Altitude: moderate, but heavy exertion
- Timing: fits with HAPE
- Fever: high for HAPE, usually $<39^{\circ}\text{C}$, 102°F
- Greenish sputum: more with infection than HAPE
- Very low SpO₂: more like HAPE
- Does it matter?
 - Needs O₂, descent
 - Can have both infection AND HAPE
 - Infection can trigger HAPE
- Further testing: HAPE susceptible



Periodic Breathing at 8000 m

