High Altitude Medicine For The Mountain Guide

Seattle Mountaineers
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Where Will You Guide Clients
In The Future?

Sierra Nevada

The Alps

Peru

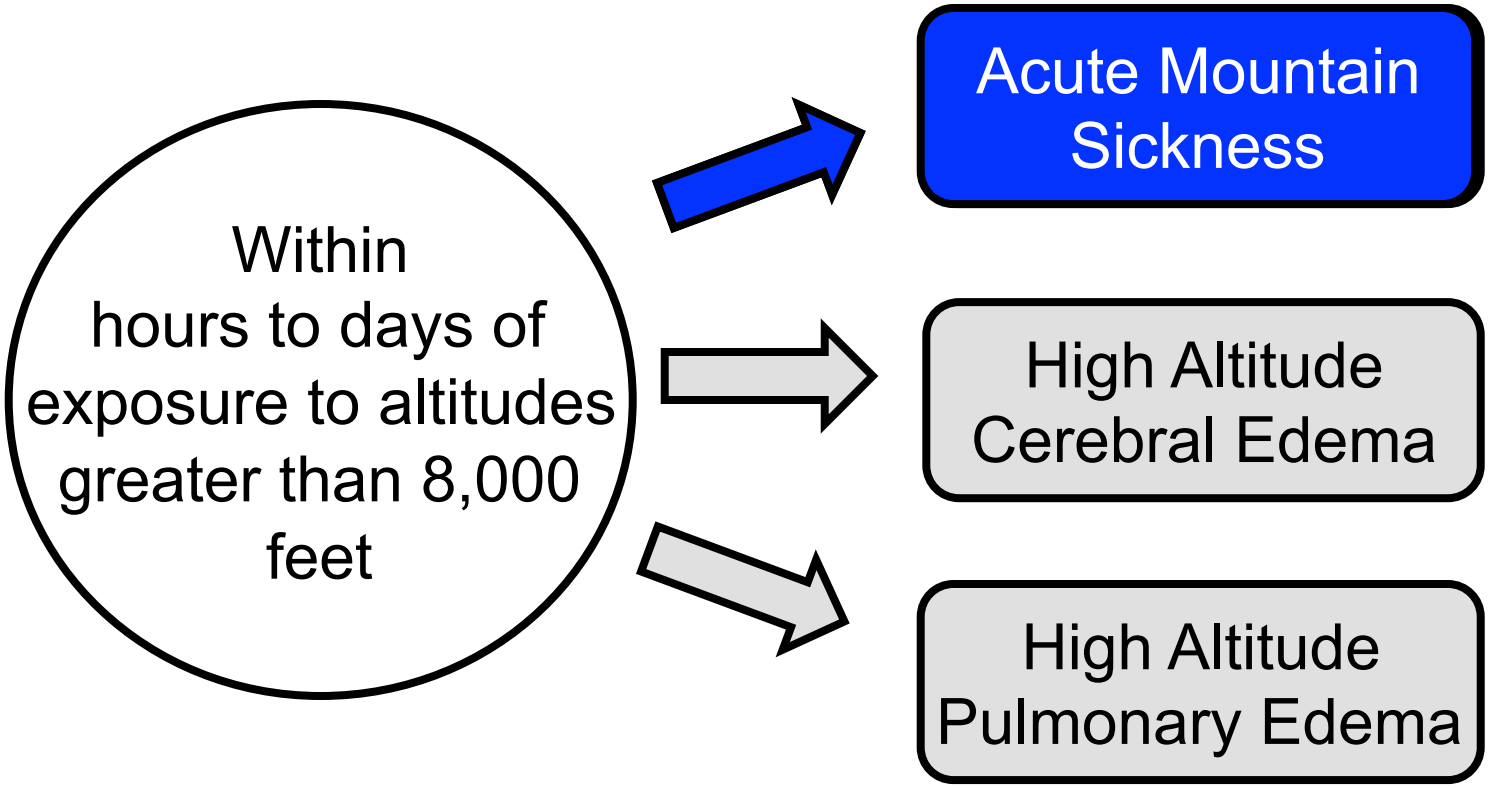
Nepal

All involve travel to potentially very high elevations

My Goal For Tonight's Session

Provide some practical tips for safe guiding into regions like these

What Are People At Risk For At High Altitude?



Above What Altitude Does Risk For Altitude Illness Begin?

(1) 6000 ft

(2) 8000 ft

(3) 10,000 ft

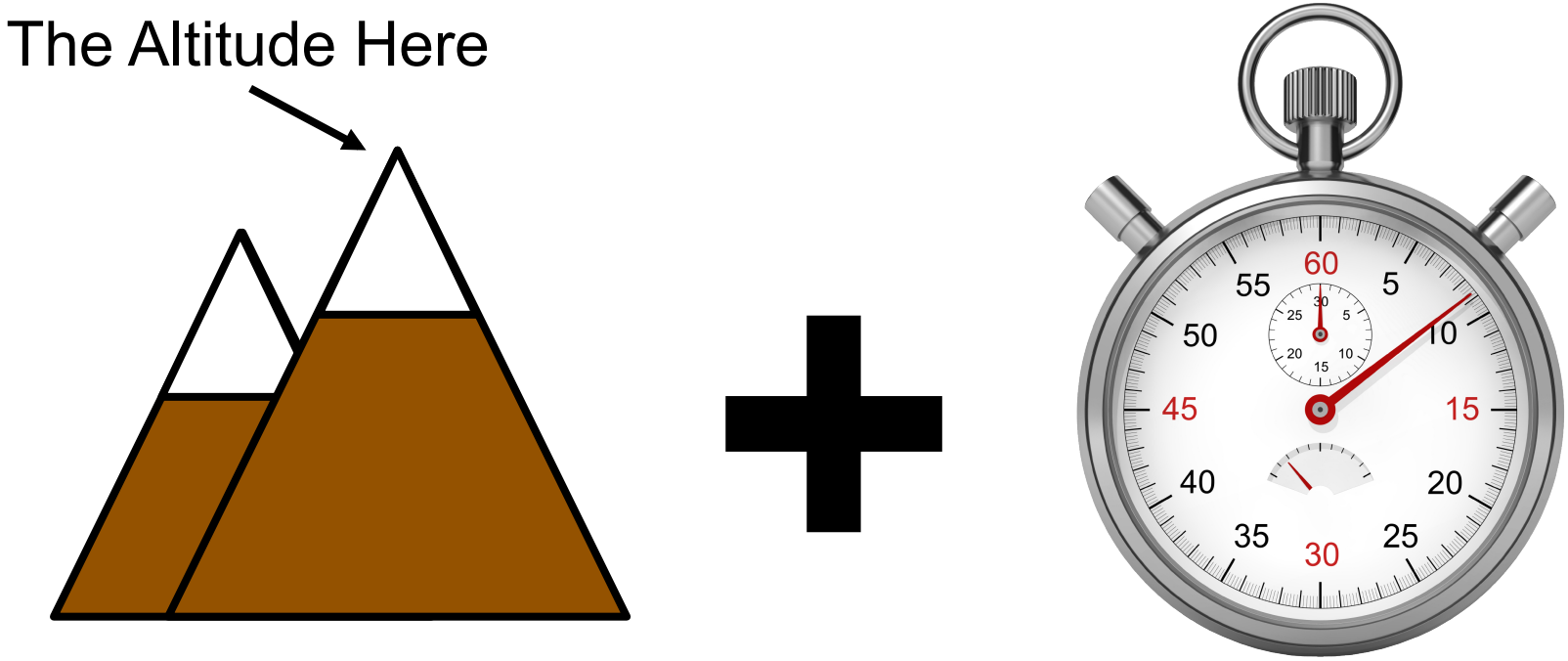
(4) 12,000 ft

Highly susceptible people can become ill at elevations below 8,000 ft. but it is uncommon

Where In The World This Matters

Alaska Range
Alps
Andes Mountains
Atlas Mountains
Ethiopia
Himalaya
Pyrynees
Kilimanjaro
Rocky Mountains
Sierra Nevada

Risk Is Not A Function Of The Altitude Alone



This is why some people can get away with single day ascents of high peaks

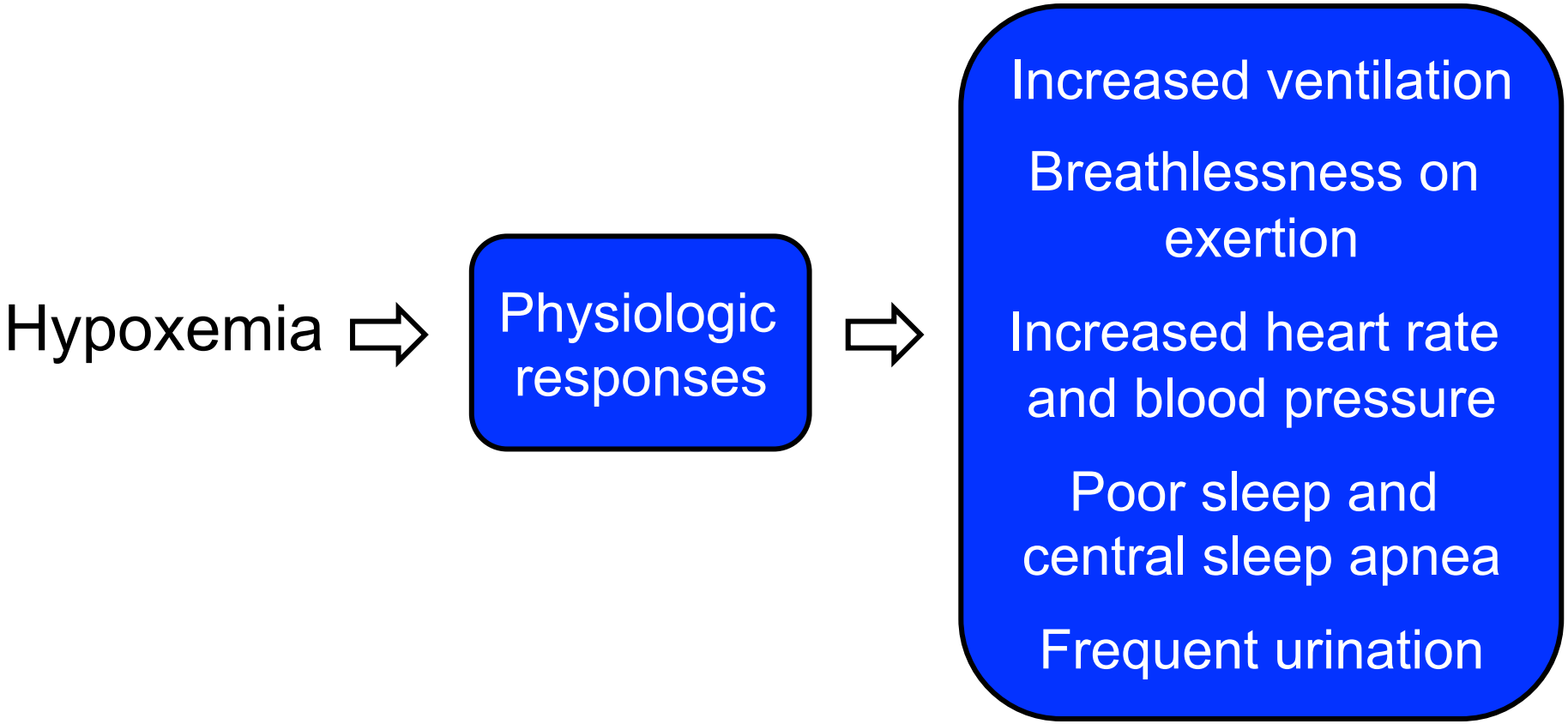

Scenario #1

Scenario 1

You are guiding a climb of Island Peak in Nepal. Upon arrival in Dingboche, a client reports to you that he feels out of breath with exertion, He does not have a cough and notes that his breathing improves within a minute or two when he rests. He has been sleeping poorly and is also concerned that his resting heart rate is 90 beats per minute (compared to 65 beats per minute at home).

? What do you tell your client in this situation?

People Feel Different At High Altitude Than At Sea Level



Do not mistake normal responses for illness!


Scenario #2

Scenario 2

That same night in Dingboche, one of your group members comes in and wakes you up because they are concerned with how their roommate is breathing during sleep. You go over to the room and observe the following:

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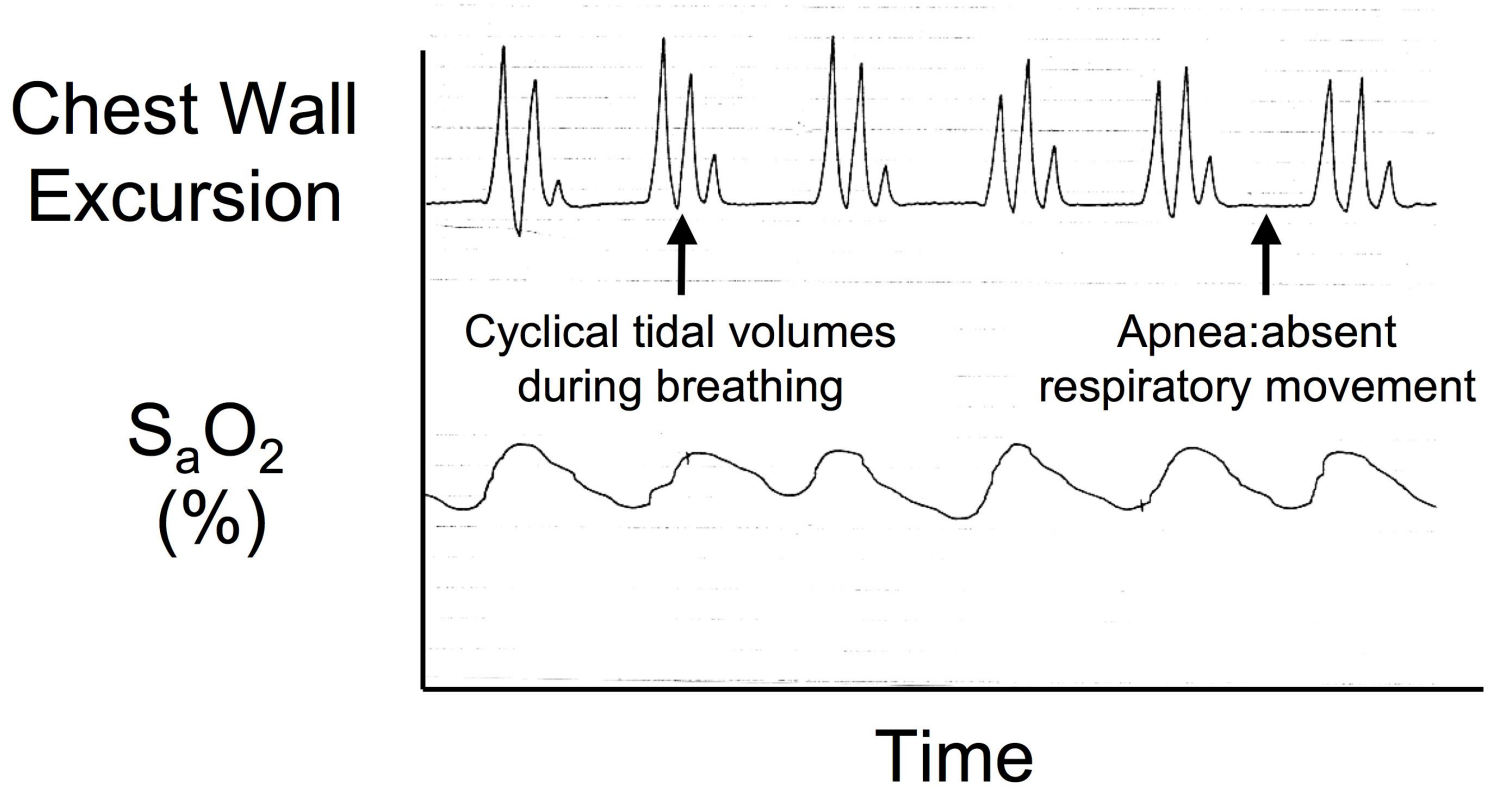
? Sick or not sick

This Person Has Central Sleep Apnea



It is a very common problem at high altitude even in people who are otherwise doing well

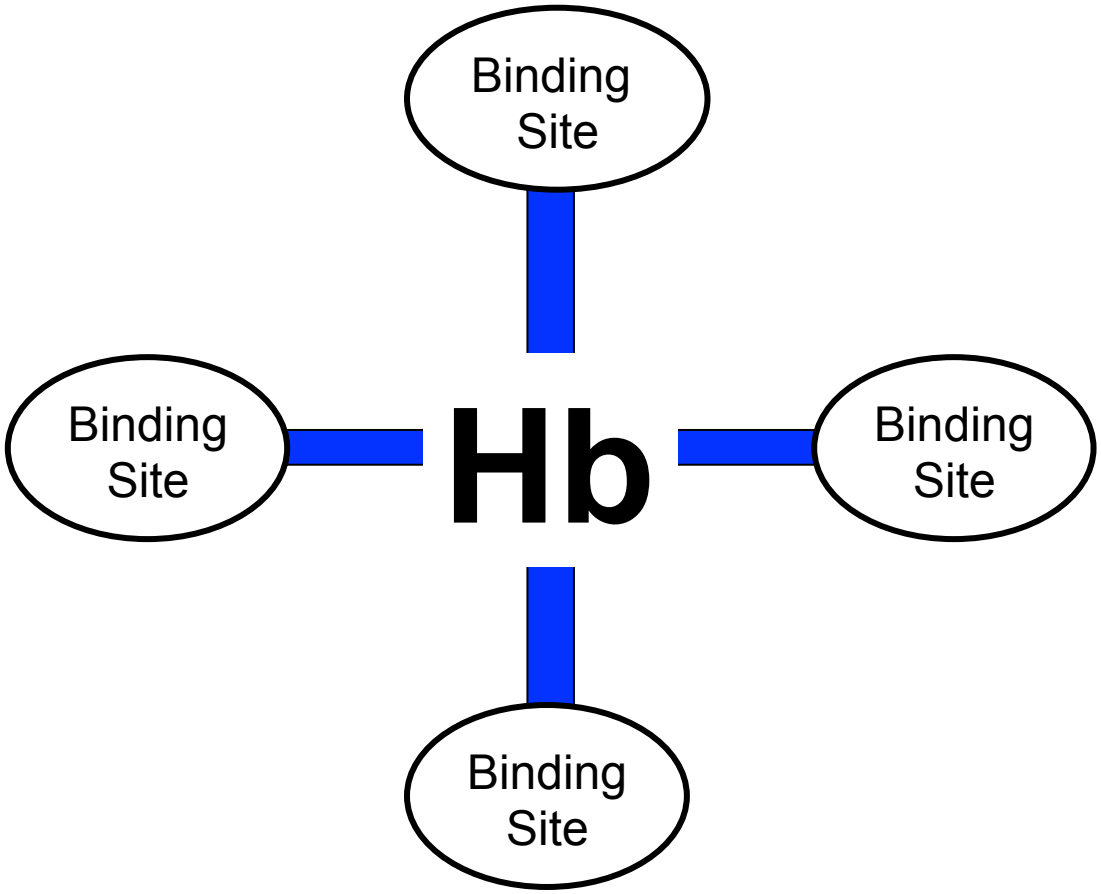

Scenario 3

Scenario 3

You are guiding a group on a trek in Bhutan and are just came down from a tall pass. On the descent, a client developed severe coughing followed by chest discomfort and difficulty breathing such that he could not keep up with the group. Upon arrival at the tea house at 14,000 ft, you check his pulse oximeter reading and it is 86%.

? What do you make of the pulse oximeter reading for this client?

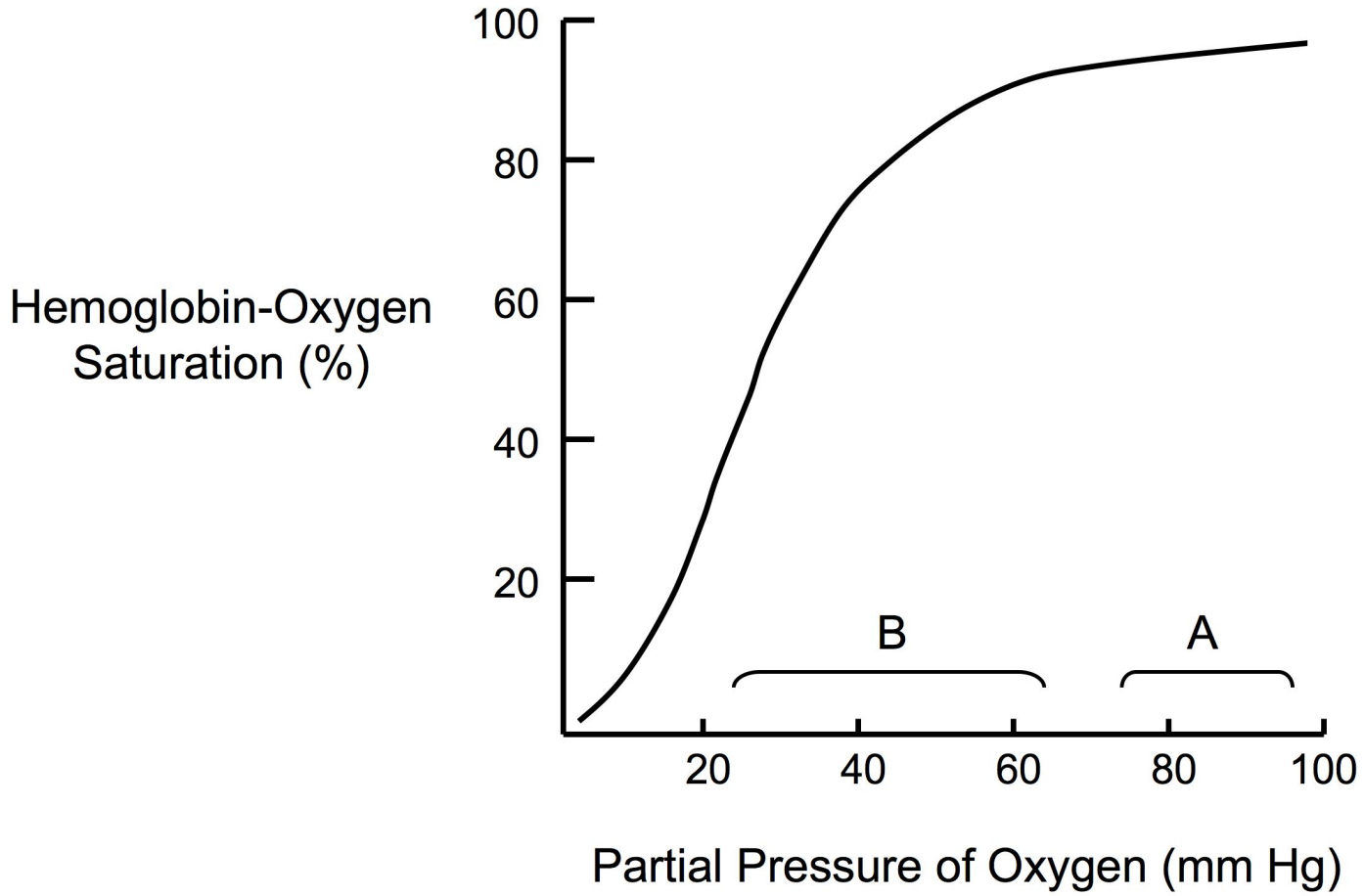
What Does The Pulse Oximeter Measure



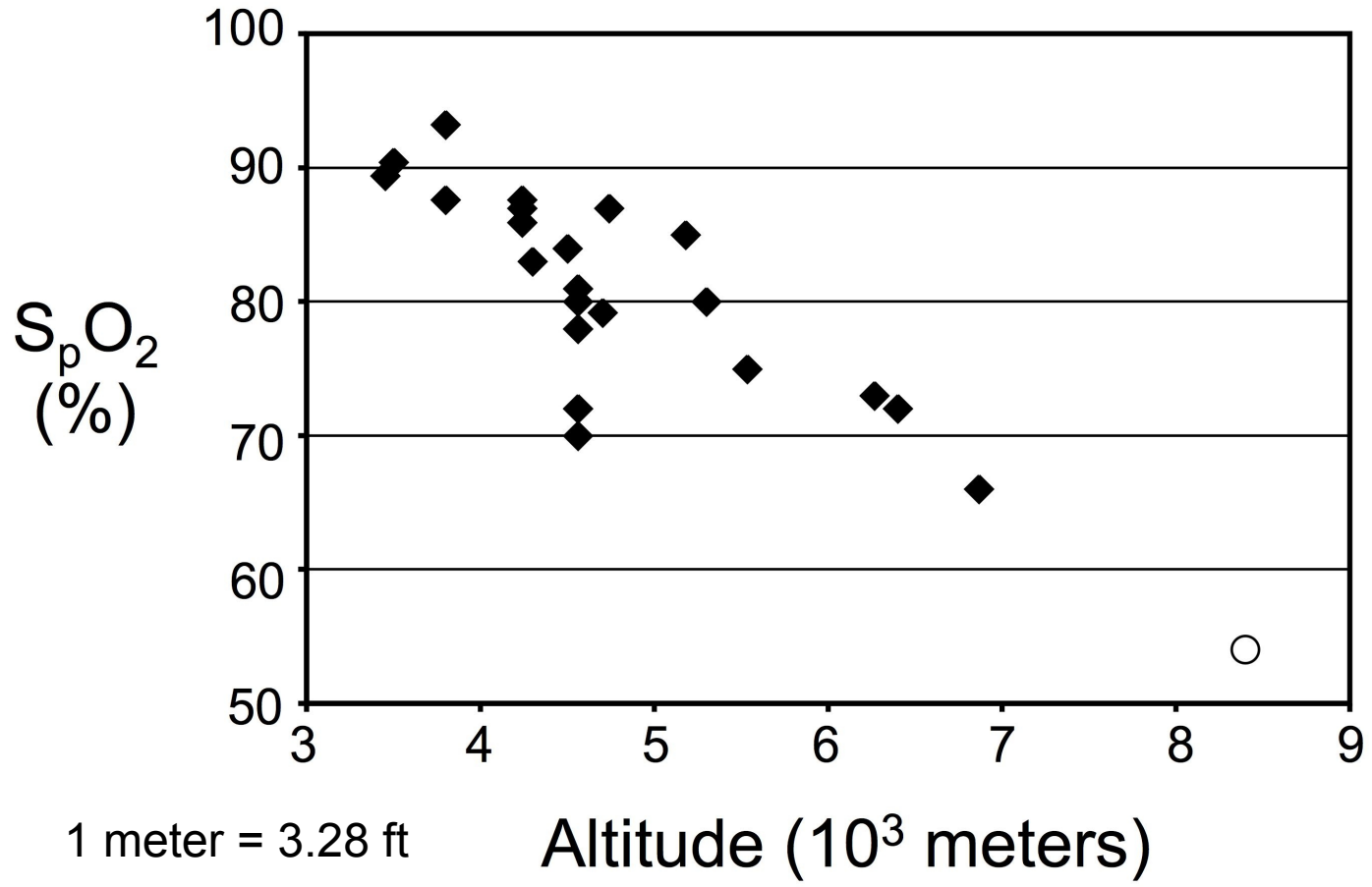
The pulse oximeter tells you what percentage of hemoglobin's oxygen binding sites are filled with oxygen at any given time, i.e., the oxygen saturation (S_pO_2)

Hb: Hemoglobin

The Saturation Is Determined By Oxygen Partial Pressure



You Need To Know The Normal Values At A Given Elevation



Tips For Accurate Measurement Of Oxygen Saturation

1. Make sure the patient is sitting at rest without talking for a few minutes
2. Ensure the finger tips are warm and well-perfused
3. Avoid excessive arm movement


Scenario 4

Scenario 4

You are guiding clients up several peaks on the Monte Rosa massif in the Swiss Alps. After arriving at the Monte Rosa Hut (2795 m), one of your clients reports he has a headache and feels "punky." He has a bit of nausea and doesn't want to eat much for dinner but has no breathing problems. His pulse oximeter reading is 90% and when you assess him he is alert but tired appearing and has a normal neurologic exam.

? What is your plan for this client?

Acute Mountain Sickness

Clinical Features

Seen 4-8 hours following ascent to altitudes above 8,000 ft

Altitude of onset has high interindividual variability

Symptoms

Headache plus one or two of the following:

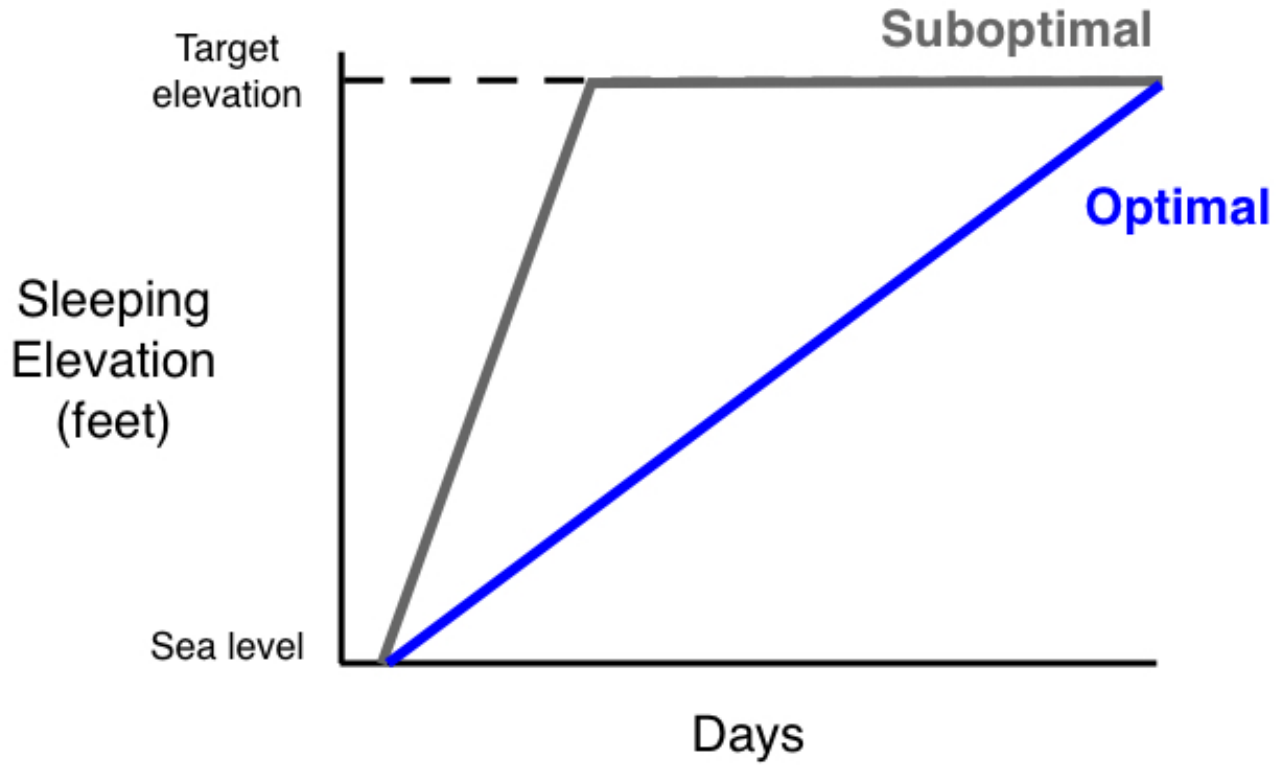
Lassitude, no appetite nausea, vomiting, persistently lightheaded or dizzy,

Mental status and neurologic exam must be normal

The Main Reason People Get Sick At High Altitude

Too High... Too Fast

Slow Ascent Remains The Best Prevention Strategy



Above 10,000 ft, limit increase in sleeping elevation to 1000 to 1500 ft/day. Rest day every 3-4 days.

Medications To Prevent Acute Mountain Sickness

Standard Options

Acetazolamide 125 mg every 12 hours

or

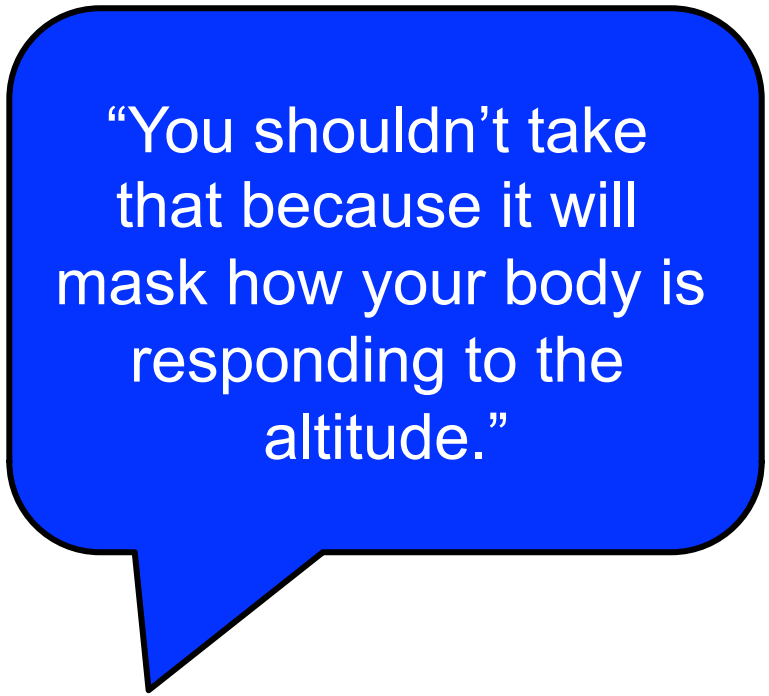
Dexamethasone 2 mg every 6 hours

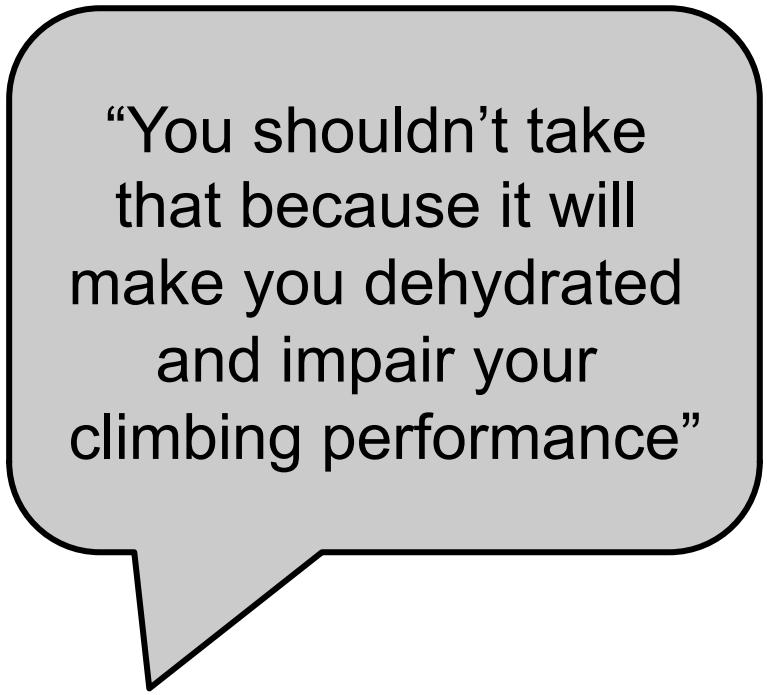
Other Things That Get Mentioned

Not ready for prime time:
Ibuprofen

These do **NOT** work:
Ginkgo biloba
Vitamin E
TUMS

Misinformation Out There About Acetazolamide





The General Approach To Treatment

Stop Ascending

Symptomatic Treatment

+/- Acetazolamide or dexamethasone

Okay to go higher if they get better

Descend, start oxygen or access a health facility

HACE: Dexamethasone

HAPE: Nifedipine

Low **High**

Spectrum of Severity


Scenario 5

Scenario 5

On the second day on the altiplano in Chile (elevation 15,000 ft), one of your partners develops increasing difficulty breathing. Whereas earlier in the trip, he had no problems keeping up, he is now falling behind going up inclines and requires frequent breaks. Following arrival in camp, he is out of breath with simple activities such as walking to the bathroom. You check his pulse oximeter measurements and finds his oxygen saturation to be 65% while sitting at rest.

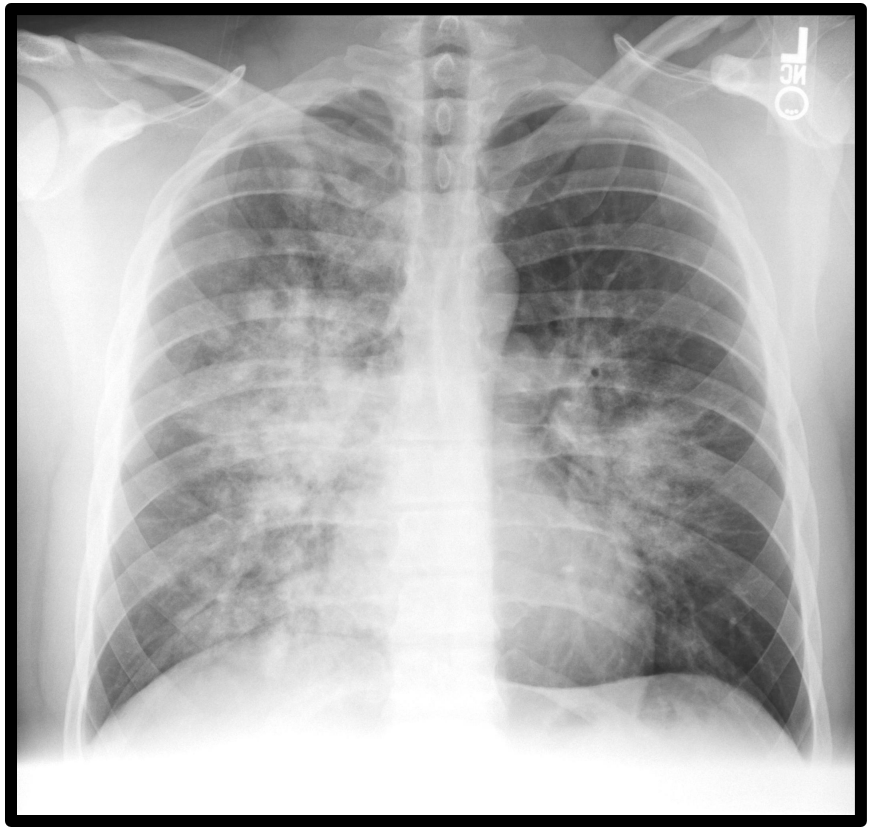
? What medication should you start

High Altitude Pulmonary Edema (HAPE)

Onset: within 2-5 days of ascent > 8,000 ft

Early symptoms: out of breath on exertion, dry cough

Late Symptoms: out of breath with simple activities, cyanosis, blood-tinged sputum



HAPE Patients Have Severe Hypoxemia

Category	P_aO_2 at 14,950 ft (mm Hg)	S_pO_2 at 14,950 ft (%)
Healthy	40 ± 5	78 ± 7
HAPE	23 ± 3	48 ± 8

It's hard to label someone as having HAPE if their S_pO_2 is within the normal range for a given altitude

Source: Bartsch et al. J Appl Physiol 1987. 63: 752

Not All Respiratory Problems Are Due To HAPE

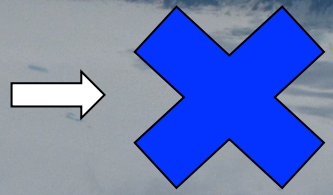
Other items to consider

Anxiety Attack
Asthma Attack
Heart Attack *
Pneumonia
Pneumothorax
Pulmonary embolism

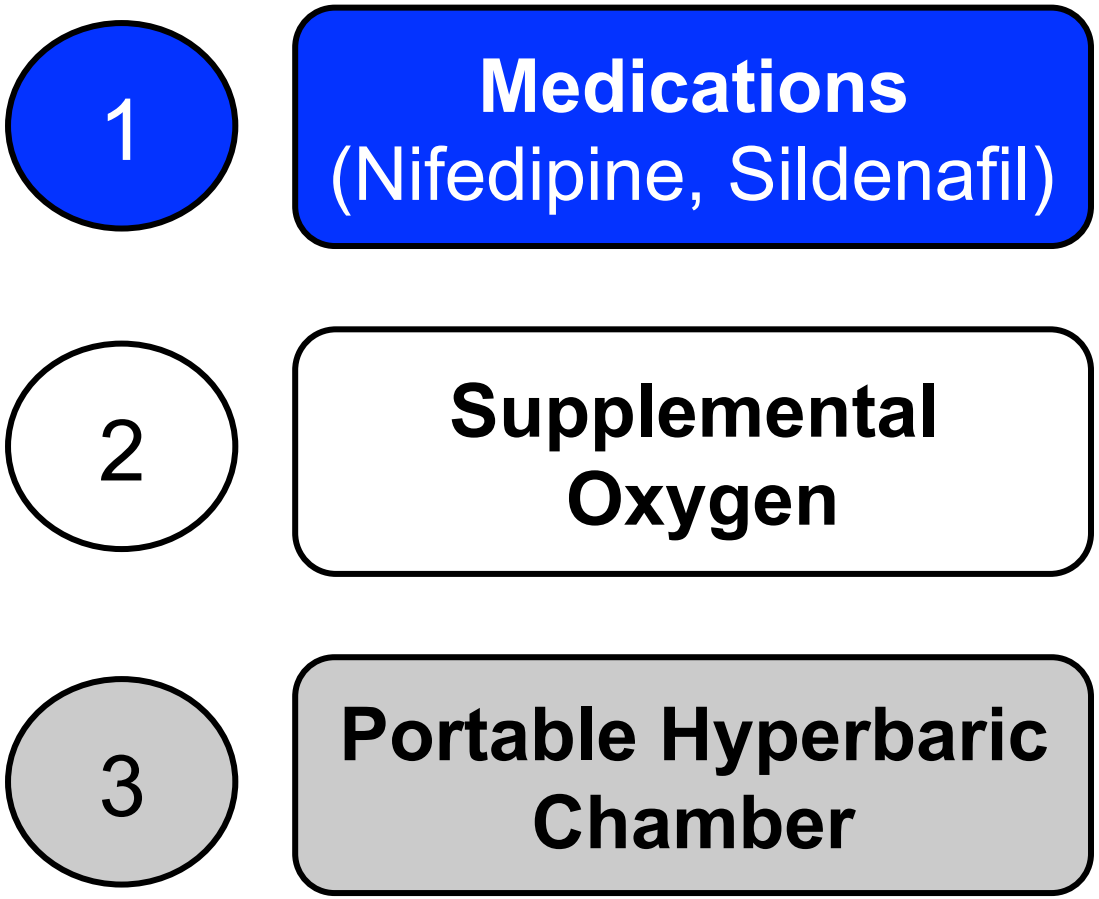
* In older individuals

Optimal Treatment For HAPE

Go Here
(i.e. get down!)



Three Options When Descent Is Not Feasible



An Option When Descent Is Not Feasible

Portable Hyperbaric Chamber:
The “Gamow Bag”

The Gamow Bag In Action

Outside the
Gamow Bag
Elevation: 14,330 ft

Inside the
Gamow Bag
“Elevation: 10,720 ft”


Scenario 6

Scenario 6

You are climbing to a pass at 18,000 ft in Ladakh. While ascending, you notice that one of the members of another group is having some difficulty walking.

In addition to descent, which medication(s) should you start?

- Acetazolamide
- **Dexamethasone**
- Nifedipine
- Sildenafil

High Altitude Cerebral Edema (HACE)

Key Information

Uncommon below 12-13,000 feet

Potentially fatal if not recognized and treated promptly

Main Things To Look For

Ataxia (clumsy)
Altered mental status
Somnolence
Coma

A Lot Of Things Can Look Like AMS And HACE

Differential Diagnosis

Bad dehydration
Carbon monoxide
Hypoglycemia
Hyponatremia *
Hypothermia
Meningitis
Physical exhaustion

When To Consider Other Diagnoses?

Abrupt symptom onset
Trauma
Focal neurologic signs
Delayed onset (> 3 days)
High fevers
No response to Rx

* Low blood sodium level

Medication Choices For Severe Altitude Illness

HACE

Dexamethasone
8 mg once then 4 mg every 6 hours

May consider adding acetazolamide (250 mg every 12 hours)

HAPE

Nifedipine (sustained release version)
30 mg every 12 hours

Alternative: sildenafil
50 mg every 8 hours

Descent is a major priority!!!


Scenario 7

Scenario 7

You are guiding a trek in the Cordillera Huayhuash. Following a trip over a high pass (17,700 ft), your client notes a problem with her vision.

How She Describes Her Vision

? Can she continue her trek?

High Altitude Retinal Hemorrhage

Common among trekkers and climbers above 5000 m

Typically no effect on vision (most remain asymptomatic)

Painless vision loss can occur with well-placed and/or large hemorrhages

Contraindication to further ascent on current trip

Other Eye Issues At High Altitude

Snow blindness (ultraviolet keratitis) can develop very quickly at high altitude, especially on snow

Overnight use of extended-wear contact lenses should be avoided due to risk of infection

Radial keratotomy patients may have problems at extreme altitudes (LASIK likely okay)

The Take Home Messages

Be able to recognize when people are sick at high altitude

The main reason people get sick is they go too high too fast

When feasible, slow ascent is the best way to prevent altitude illness

Descent is the single best way to treat altitude illness but is not always needed