High altitude illness

- High altitude illness
  - AMS
  - HACE
  - HAPE

- Immune system
  - Hygiene

- Temperature regulation
  - Heat illness
  - Cold injury

- High altitude illness
  - Explanation
  - Symptoms
  - Causes
  - Prevention
  - Treatment
Acute mountain sickness

“A self-limiting condition affecting previously healthy individuals going rapidly to high altitude”
“It is a curious fact that the symptoms of puna do not usually evince themselves at once. The majority of newcomers have expressed themselves as being quite well on first arrival. Towards the evening, the patient begins to feel slack and disinclined for exertion. He goes to bed but has a restless and troubled night and wakes up next morning with a severe frontal headache.”

Ravenhill, 1913
“It is a curious fact that the symptoms of puna do not usually evince themselves at once. The majority of newcomers have expressed themselves as being quite well on first arrival. Towards the evening, the patient begins to feel slack and disinclined for exertion. He goes to bed but has a restless and troubled night and wakes up next morning with a severe frontal headache.”

Ravenhill, 1913
AMS: Incidence

3600m = 34%

4800m = 46%

(Maggiorini et al., 1990; Tsianos et al, 2006)
AMS: Symptomology

- Onset 6-24 hours, peak 2\textsuperscript{nd} to 3\textsuperscript{rd} day
  - Headache
  - Anorexia
  - Nausea
  - Vomiting
  - Fatigue
  - Light-headedness
  - Sleep disturbance
- Immediate arrival: asymptomatic
- History of recent height gain
AMS: Signs

- History important
- Examination
  - Crackles in chest?
  - Peripheral swelling?
  - Mild fever?
  - Speech impairment?
  - SaO₂ lowered?
# Lake Louise Consensus

**AMS Score:** Self Report Questionnaire

AMS = Altitude Gain AND Headache AND at least 1 other symptom AND a total score of 4 or more

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Headache</td>
<td>0</td>
<td>No headache</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Mild headache</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Moderate headache</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Severe headache, incapacitating</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Gastrointestinal symptoms</td>
<td>0</td>
<td>No gastrointestinal symptoms</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Poor appetite or nausea</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Moderate nausea or vomiting</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Severe nausea &amp; vomiting, incapacitating</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Fatigue and/or weakness</td>
<td>0</td>
<td>Not tired or weak</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Mild fatigue/ weakness</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Moderate fatigue/weakness</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Severe fatigue/ weakness, incapacitating</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Dizziness / light headedness</td>
<td>0</td>
<td>Not dizzy</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Mild dizzy</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Moderate dizziness</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Severe dizziness, incapacitating</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. Difficulty sleeping</td>
<td>0</td>
<td>Slept as well as usual</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Did not sleep as well as usual</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Woke many times, poor nights sleep</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Could not sleep at all</td>
</tr>
</tbody>
</table>

Roach *et al.*, 1993
AMS: Mechanisms

Normal foot

Foot with edema

(Hackett & Rennie, 1979)
AMS: Mechanisms

Exercise

$O_2 \downarrow 5\%$

(Roach et al., 2000)
AMS: Mechanisms
AMS: Mechanisms
AMS: Lifestyle prevention

- Follow recommended acclimatization profiles?
  - 300m per day
  - Rest day every three days

- Fluid intake
  - Anecdotal data suggests drink drink drink drink
    - > 5 L a day intake = less AMS
    - Hyponatremia?

- Herbal remedies
  - Gingko biloba
  - Coca

- Fitness

(Basnyat et al., 1999; Hackett, 1987; Murdoch, 1999; MEDEX, 2008)
Training

• “Physical training in un-sportsmanlike and not in the true spirit of competition!”
AMS: Drug prophylaxis

- Acetazolamide (Diamox®)
  - Dose
    - 250mg twice daily
  - Side effects
    - Makes you pee more
    - Tingling sensation
    - Tummy upset
    - Carbonated drinks
  - How does it work?
    - Inhibition of certain enzymes
      - Better sleep
    - Urination
      - Breathe more

(West, 2004)
AMS: Treatment

- Do not ascend
- Resolves within 24 - 48 hrs
- Rest
- If symptoms do not disappear or worsen
  - DESCEND

1000mg 4x per day

400mg 3x per day
**AMS: Treatment**

- Acetazolamide?
  - 250mg 3x daily
- Dexamethasone?
  - 4mg 4x daily
- O$_2$?
- Gamow bag?
High Altitude Cerebral (O)Edema
HACE: Incidence

4500m = 1%  

(Hackett et al., 1976)
HACE: Symptomology

- As for AMS
- Plus
  - Ataxia
  - Altered consciousness
  - Blurred vision, hallucinations
  - Coma
HACE: Signs

- Extensor plantar response
- Fever
- Blue lips, tongue, nails
- High resting heart rate
- High breathing rate
HACE: Prevention/treatment

- Prevention
  - As for AMS

- Treatment
  - DESCEND
  - Sit upright
  - Keep warm
  - $O_2$
  - Gamow bag

8mg then 4mg every 6 hours

250mg 3x per day

250mg 3x per day
High Altitude Pulmonary (O)Edema
HAPE: Incidence

4500m = 5.2%

(Basnyat, 2005)
HAPE: Symptoms

- Rapid ascent
- Exercise
- Possible AMS symptoms
- Shortness of breath
- Lethargy
- Chest pain
HAPE: Signs

- High heart rate
- High breathing rate
- Cough
  - Dry
  - White sputum
  - Bloody sputum
- Crackles on chest
- Blue lips, tongue, nails
- Mild temperature elevation
HAPE: Prevention/Treatment

- **Prevention**
  - As for AMS
  - Slow ascent
  - Avoid exercise for 72h!

- **Treatment**
  - DESCEND
  - O₂
  - Gamow bag
  - Diuretics???

250mg 3x per day

20mg slow release every 6 hours

(Anholm et al., 1999; Oelz et al., 1989)
Compromised immune function
Hygiene

- Incidence of diarrhoea
  - 1 day per 75 days wilderness exposure

- Causes
  - Principally pathogens from faeces

- Prevention
  - Hand washing
  - Vitamin consumption
  - Washing of utensils in warm soapy water
  - Water purification

(Boulware, 2004)
Hygiene
Cold injury & heat illness

(Golja, 2008)
Dehydration and body temperature

Body temperature (°C)

Time (min)

IMPORTANT! DEHYDRATION RAISES THE RISK OF HEAT STROKE (HYPERTHERMIA)!

NO FLUID

FLUIDS
Skin

- Dry cracked skin
- Lengthened wound healing
Eyes

- Snow blindness
  - Prevention
    - Reduce glare by any means, even in cloud!
  - Treatment
    - Rest, padding eyes, eye drops

- Retinal haemorrhage
  - Descend if lose vision
And finally…
Resources

- http://extremes.bangor.ac.uk/news
- http://www.ismmed.org/np_altitude_tutorial.htm
- http://www.theuiaa.org/medical_advice.html
- www.medex.co.uk
- www.high-altitude-medicine.com
- www.traveldoctor.co.uk
- High altitude medicine handbook (Pollard & Murdoch)
- Pocket first aid and wilderness medicine (Duff & Morley)
Tool box