Cardio Vascular Issues At High Altitude But not On: Ama Dablam 22,500 ft.
HIGH-ALTITUDE CV Issues

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Disclosure # 1

– I have NO conflicts of interest to report

Disclosure # 2

– Much of this is NOT evidence based

– At least not GOOD Evidence
What We’ll Cover

• Common stuff we see
  • and Why YOU need to know

• AMS (Because all in CO should recognize it)

• HAPE (It might show up here in transfer)

• Risk Factors

• Resources
Operation Everest II
Simulated 28,029 ft.
Categories at High Altitude

• High: 1500 to 3500 m (4,921 – 11,483 ft)

• V. High: 3500 to 5500 m (11,483 – 18,045 ft)

• Extreme: 5500 to 8850 m (18,045 – 29,035 ft)
Case: 58 YO Man

“Severe MR”
BIO-Prosthetic  MVR 1 Month ago NYC
NORMAL Cors, EF 60% Post OP
Returned to Denver 1 week
Edwards 2 days prior to Eval
Progressive dyspnea
CXR: Right sided Moderate Pleural effusion
GIVEN: Furosemide 40 mg QAM
1 week later worse: PND, Orthopnea, walks 50 ft. Sat 89% at 6300 ft.
Repeat Echo EF 85%, NO WALL MOTION ABN
HIGH velocity through MV, High gradient
INR 1.9
WHAT WENT WRONG?
Variables Influencing Altitude Illness

- Rate of ascent
- “Sleeping Altitude”
- Exertion
- Cold Or Winter
- Barometric Pressure TODAY
- Summer/Winter
- Physical fitness is not protective

- Prior history of High Altitude Illness
- Maximum
- Duration

Physical fitness is not protective
MAIN SYNDROMES

Acute Mountain Sickness (AMS)

High Altitude Cerebral Edema (HACE)

High Altitude Pulmonary Edema (HAPE)
Incidence

- AMS reported as low as 6,500 ft.
- HAPE reported as low as 7,500 ft.
- HACE reported as low as 8,000 ft.
- Colorado resorts?
  AMS 25%+
Acute Mountain Sickness (AMS)

- Diagnoses – clinical
- Usually NORMAL physical exam
- Pulse oximetry – poor correlation
- Ataxia – consider HACE
AMS – Definition
(The Lake Louise Consensus Committee)

• Headache with one or more of the below:
  1. anorexia, nausea or vomiting
  2. fatigue or weakness
  3. dizziness or lightheadedness
  4. difficulty sleeping

• Occur in the setting of recent arrival to altitude (above 2500m)
AMS: Medication treatment

- Acetazolamide 125-250mg BID PO
- Dexamethasone 4mg q6h PO/IM/IV
- Ginkgo biloba
- Nifedipine XL 30 mg BID

- REMEMBER WADA AND Global DRO for Athletes
AMS: Return to prior activity

- Normal room air $\text{SaO}_2$
- Can maintain $\text{SaO}_2 > 90\%$ with heavy exertion
- Must be symptom free for 24-48 hours off supplemental $\text{O}_2$
Back to The Heart
PFO/ASD

1. **52 YO Woman moved to Avon, 7500 ft.**
   - From C. Springs
   - Lots of weekends in Vail area
   - Severe DOE bicycling
   - Echo showed Secundum ASD

2. **Wife of Doctor from this institution Thal Minor**
   - Ready to buy 2nd home in Avon:
     - I Suggested 2 week trial
     - Severe DOE hated mountains but “I’ll adjust”
   - Day 9 of 14 day vacation Back to Denver: PFO

Sale Lost for agent
52 YO CEO from Sea Level

2nd Home owner in BC

Cardiology consult Day 3 in hospital for TIA:
  TEE negative

3 months later SAME THING

6 Months Later, TIA # 3
  OOPS What did I miss?

1 month Later, ONLY IN VAIL!!!!!
CAD

VERY LITTLE DATA

ONCE Revascularized = FINE

Don’t stress test at low altitude to predict High Altitude Tolerance

MY IDEA to Promote Tourism

“Come to Colorado, We’ll Find Your Heart Disease Sooner”

Empiric: KEEP Hb >= to 10
Hypertension

51 YO Physicist from East Coast Medical School

HA

260/162

36 hours later at home 120/72

Over the years:

Years Later: HTN, Daughter at CU,
HTN

- Very Little Data or Publications
- VERY IMPORTANT
- “I’ve never had a problem before”
- DID YOU EVER CHECK?
- 52 Y.O. RN 7100/5300 ft.
  - 150/90 / 120/72
Sleep apnea

HIGH ALTITUDE MEDICINE & BIOLOGY, Last month 2016

DOI: 10.1089/ham.2016.0027

Association of Cardiovascular Disease and Sleep Apnea at Different Altitudes

Above 9000 ft., prevalence Changes every 500 ft. IN MY Experience

CLEARLY A/W HTN and A Fib
Warfarin

2 main studies Lots of Stuff on net.

FIRST:


Risk of impaired coagulation in warfarin patients ascending to altitude (>2400 m).

From Vail, Van Patot, Hill, Dingman, Gaul, Fralick, Christians, Honigman, Salman

Second:

*Anticoagulation Considerations for Travel to High Altitude*

Warfarin Cont.

- CHECK INR after 3-4 days
- Not sure if goes up or down
- NOACs: “NOT affected by altitude”
- OF COURSE WARFARIN Wasn’t supposed to be either
Case: 58 YO Man

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WHAT WENT WRONG?
RESOURCES
Local Resource

Dr. Peter Hackett
Institute For Altitude Medicine
HAPE: Diagnosis

• Early symptoms:
  1. diminished exercise performance
  2. dry cough
HAPE: Definition

(Lake Louise Consensus Definition)

• And at least 2 signs:
  1. crackles or wheezing
  2. central cyanosis
  3. tachypnea
  4. tachycardia
HAPE: Diagnosis

- Edema: presents 1-4 days; rarely after 4 days
- Reported as low as 8,000 ft.
- Rate of progression accelerated by:
  1. vigorous exercise
  2. cold exposure
  3. continued ascent
After 3 hours of $O_2$ treatment
HAPE: Diagnosis

• Recently arrived at altitude
• Respiratory distress
• Right mid-lung filed rales
• Low $\text{SaO}_2$ by pulse oximetry
• CXR: patchy infiltrate and lack of cardiomegaly
HAPE: Definition

(Lake Louise Consensus Definition)

• At least 2 of the following symptoms:
  1. dyspnea at rest
  2. cough
  3. weakness or decreased exertion performance
  4. chest tightness or congestion
HAPE: Treatment

• Nifedipine 10mg initially, then 20-30mg extended release BID
• Salmeterol Inhalation – preventative
• Expiratory Positive Airway Pressure Mask
• Hyperbaric Treatment 2-15 psi
• None of the above more effective than supplemental oxygen
HAPE: Treatment

• Oxygen to keep SaO$_2$ ≥ 90%
• Assure adequate hydration
• Recheck O$_2$ saturation after initial high flow O$_2$ treatment
• Consider 1-3 days of continuous O$_2$ at 1-4 L/min
• Rest
HAPE: Prevention

• Viagra 50mg
• Cialis 10mg q12h × 2
HAPE: Return to prior activity

- Normal room air \( \text{SaO}_2 \)
- Can maintain \( \text{SaO}_2 >90\% \) with heavy exertion
- Must be symptom free for 48-72 hours
High Altitude Cerebral Edema (HACE)

- Diagnosis – clinical
- Findings present on physical exam
HACE: Symptoms

- Ataxia and/or altered level of consciousness in someone with AMS or HAPE
- Develop 3 to 5 days after arrival to altitude
- Cases have occurred as low as 9,000 ft.
- Symptoms can progress to death over hours
HACE: Symptoms

- Mental status changes may include:
  1. irrational behavior
  2. lethargy
  3. obtundation
  4. coma
HACE: symptoms – Physical findings

- Truncal Ataxia – Diagnostic
- Papilledema
- Retinal hemorrhage
- Cranial nerve palsies
- Abnormal reflexes
- Rarely: focal Neurologic deficits
HACE: Treatment

- Descent
- Supplemental oxygen ($\text{SaO}_2 > 90\%$)
- Dexamethasone (8mg PO/IM/IV initially then 4mg q 6h)
- Recovery from HACE may be prolonged