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HACE

High Altitude Cerebral Edema or HACE for short, is a condition that occurs as a result of hypoxia in altitudes in excess of 2000 meters or 6560 feet. HACE can be potentially fatal as it causes the brain to swell and stop functioning a normal manner.

As I've mentioned before, HACE can affect anyone, at any time and on any climb. There are, however, contributing factors which increase the incidence and severity of the illness, these include:

- Rate of ascent,
- The altitude attained,
- The amount of physical activity at high altitudes, and
- An individual's susceptibility.

Pathophysiology

Cerebral oedema is consists of 4 subtypes:

- Vasogenic – occurs when there's a breakdown in the endothelial junctions of the blood-brain barrier.
- Cytotoxic – occurs when there's a disruption in cellular metabolism impairing the functioning of the sodium and potassium resullting in salt and water retention.
- Osmotic – occurs when an abnormal pressure gradient causes water to move into the brain.
- Interstitial – occurs in obstructve hydrocephalus from the rupturing of the CSF-brain barrier.

HACE is a form of vasogenic oedma. The junctions between the endothelial cells breakdown, allowing intravascular proteins and fluids to enter the extracellular spaces of the brain. Once this happens, the spread is rather rapid and extensive. The fluid affects both the white and gray matters of the brain. The fluid is endless, filling all the open spaces of the brain. When the spaces are filled, the fluid doesn't stop, it continues to flow, increasing the pressure within the brain and forcing the fluid to press harder and harder against the tissues and structures of the brain. This compression leads to the wide variety of symptoms experienced.

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Incidence Rate

Studies and reports have shown that only 0.5% to 1% of trekkers while experience HACE in altitudes between 4000 to 5000 meters. There have been unusual reports where up to 30% of members on an expedition developed HACE.

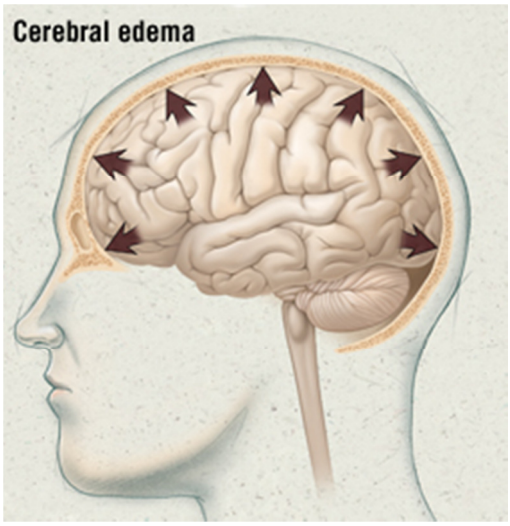
This severe form of AMS is seldomly seen below 3000 meters but there have been exceptions where trekkers have begun seeing symptoms as low as 2500 meters. The condition generally does not occur until an individual has spent 48 hours at an altitude of 4,000 meters.

Symptoms

Knowing the symptoms of HACE is the best way to keep yourself safe while on your trip. It also allows you to catch it at the beginning stages before coming too serious and life-threatening. The symptoms do vary depending on the severity.

The symptoms you need to keep an eye out, in order of appearance include:

- Confusion
- Changes in behaviour
- Fatigue
- A ‘drunken stagger,’ also known as ataxia.
- Difficulty speaking
- Vomiting
- Hallucinations
- Blindness
- Paralysis of a limb
- Seizure
- Unconsciousness
- Total paralysis
- Coma



Treatment

Since you’re on a mountain, all the tools, equipment and medications you will find at your local hospital won’t be available.

Even though this may be the case, expedition doctors will have everything necessary to treat HAPE on the spot. The main treatment protocols will be as follows:

- Rapid descent,
- Reduce physical activity,
- Dexamethasone helps alleviate symptoms, but can mask symptoms as well causing them to reappear at a later stage,
- Oxygen supplementation will alleviate symptoms,
- If available, portable hyperbaric chambers will be use to imitate a descent,
- Diuretics may be administered such as Sildenafil and Tadalafil to help with HACE but little evidence supports their efficacy, while Theophyline has been theorised to help with the condition,
- If your condition is severe, a helicopter rescue may be necessary.

Lifestyle

There are multiple lifestyle changes you can implement that may help prevent developing HACE while on your trip.

Some of these changes might be recommended by your doctor after your physical exam but they are generally changes that lead to a healthier lifestyle.

- Controlling high blood pressure
- Control high blood glucose levels if you suffer from diabetes
- Quit smoking
- Maintain and eat a healthy diet, preferably low-salt diet
- Maintain a healthy weight
- Exercise regularly, this should both strength training and cardiovascular exercise. You should try training with all of your gear at least once a week.

Complications

The complications of HACE are secondary conditions, symptoms, or other disorders that are caused by High altitude cerebral edema. Most times the distinction between the symptoms and complications of HACE are somewhat unclear and arbitrary.

The list of complications mentioned by various sources include:

- Coma
- Death

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Prevention

There are a things you can do before leaving and while on your trip to prevent developing HAPE. I hope the following trips will keep you safe on your travels.

- Acclimatize yourself at your own pace,Ascend to high altitudes slowly and steadily, no more than 305-366 meters per day once reaching 2500 meters,Sleep no more than 300 meters above the previous night's altitude
- Rest an extra day for every 183-366 meters when at high altitudes
- Medications such as Dexamethasone and Acetazolamide.

Prognosis

HACE is a serious condition no matter which stage you're experiencing and can be fatal. If the condition is caught early and treatment started with 12 to 24 hours the outcome is good.

The recovery period of someone with HACE varies from days to weeks but generally most recover within a few days. However, if treatment is only delayed past the 24-hour mark, the chances of a good prognosis begin to decline with an ever increasing risk it may be fatal.

In one study, it took patients anywhere from a week to a month to display normal CT scans after HACE, while this was dependent of the severity of the condition.