

COMMON MOUNTAIN HAZARDS AND MEDICAL AIDS

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Abstract: Why do people climb mountains? “*Because they are there*”. Mellory said. The high danger associated with the mountaineering places the mountaineers at high risk for injury and or death in the case of an accident or mistake. Body needs some time to adjust adverse conditions, which is called “Acclimatization”. All the mental and physical problems and symptoms starts beyond a height of 12000 feet above MSL.

Mountaineering sport which demands utmost physical endurance, mental, robustness and emotional stability. Since mountaineers are exposed to fatal DANGERS and OTHER HAZARDS, they have to CONQUER FEAR, overcome PHYSICAL & MENTAL HARDSHIPS.

Mountaineering involves four principal activities -walking, rock climbing, snow or ice climbing and navigation. Mountaineering is all about taking on challenges, learning about ourselves and most of all about our potential.

Lack of knowledge about mountains can cause for mishaps and failure of expeditions but fortunately, death is preventable if climbers gain an understanding of the cause of death and learn to take precautions and make positive decisions that help to prevent death from occurring.

Keywords: Medical Aids, Environment, Hazards, Mountaineering.

Introduction:

According to Oxford Dictionary a hazard means a danger or risk. Hazards can be termed as natural (caused by natural occurrence) and man-made (caused by an individual, such as lack of preparation, carelessness, improper diet, equipment misuse). A simple mistake on the mountains may lead to permanent disability or even death. The mountaineers must be well trained and conversant with various mountain hazards while operating in mountains and snow-clad areas.

There are two types of hazards faced by mountaineers while operating in the high mountains:

- I. **Objective Hazards:** Objective Hazards are caused by the mountain and weather and cannot be influenced by a person operating in the mountain. Snow group Hazards, i.e Avalanches, Landslides, Falling stones, Soft Snow, Glaciers, Crevasses, Hanging glaciers and Seracs, Cornice, snow bridge etc.
- II. **Subjective Hazards:** Subjective hazards are created by humans, which are directly connected with the movements and activities of the climber. For example, choice of routes, companions, over exertion, psychological hazards, dehydration, climbing above one’s ability, and poor judgment, falling, camp site, equipment are the main Subjective hazards.

Health Hazards, are one of the most fatal hazards faced by mountaineers, i.e. Hypothermia, Frost bite, (HAPO) High altitude Pulmonary Oedema, (HACO) High altitude cerebral Oedema, (AMS) acute mountain sickness, Sun burns, chilblains, Benightment etc.

I. OBJECTIVE HAZARDS:

- i. **Avalanche:** This is one of the most dangerous hazards in the mountains. The main causes of avalanche are sudden rise of temperature, slope, weight shearing, and any trigger action. Avalanche is a massive mass of unstable snow and / or ice that can come hurtling down a slope and brings with it snow, ice, rocks, soil, trees etc. Any slope above 30 degrees is prone to avalanche. Once melting starts friction between the two layers the top layer of snow is ready to avalanche either by its own weight or by the wind or by disturbance by the mountaineer. Avalanche is a dangerous and life-threatening hazard in mountains, the chances of survival of an avalanche victim are estimated at 85% percent, if rescued within 15 minutes, 50% within 30 minutes, 20% within one hour.
- ii. **Soft Snow:** Excessive snow fall makes movement very difficult. Movement on soft snow is very slow and tiring. Trugger shoes or skis can be used to move easily on soft snow.
- iii. **Glaciers:** Movement on glaciers is difficult especially while climbing the slopes. Ice axe and crampons are used to move in glaciers.
- iv. **Crevasses:** (Hidden & Open) hidden crevasses are more dangerous because they are covered with fresh snow in which crevasses with narrow mouths are completely hidden. Crevasses are formed when a glacier moves over a slope and makes a bend, or when a glacier separates from the rock walls that enclose it. They can be very wide and deep making movement very difficult on glaciers. Crevasses can be crossed by constructing rope bridges or by launching a ladder.
- v. **Hanging Glaciers and Seracs:** A pinnacle or tower of ice. Better to avoid them if possible. They may fall without warning regardless of the time of day or time of year. One cubic meter of glacier ice weighs 910 kilograms. If one needs to cross these danger areas, do so quickly and keep an interval between each climber.
- vi. **Cornice:** A consolidated snow bank projecting over the edge of a ridge, plateau or Corrie, and formed by prevailing winds. They may be temporary which are very likely to avalanche, or they may be permanent. While selecting a route in snow bound areas avoid moving below and over a cornice.
- vii. **Snow Bridge:** A bridge formed over a crevasse or a stream which is not very strong is always a hazard for people moving in snow bound areas. To avoid these bridges team should probe the route along which they are moving

WEATHER HAZARDS - Weather plays an important role in mountaineering expeditions. It is extremely variable and unpredictable in the high altitudes. Storms come and blow away suddenly. Weather conditions in the mountains may vary from one location to another as little as 10 km apart. The main weather hazards are enumerated below: -

- (i) Storms (ii) wind Chill factors (iii) Low visibility (iv) Lightning (v) White Out vi) Altitude Etc.
- (i) **Storms:** Storms accompanied by high winds and large quantities of snows. The best thing to do is to seek shelter at a safe place until it blows out. Blizzards with greater wind velocity are all the more deadly.

- (ii) Wind Chill factors: Wind has a chilling effect at the higher altitudes. Winds are stronger and more variable in mountains. The effect of low temperature is compounded by the heat extracting effect of the wind and the two in combination should be taken into account.
- (iii) Low Visibility: Fog, rain, darkness, and blowing snow cause poor visibility which can lead to disorientation.
- (iv) Lightning: Lightning and thunder storms are great hazards in the mountains. Lightning is frequent, violent, and normally attracted to high points and prominent features in mountain storms. One should stay away from tent poles, metal objects and walkie talkie aerals. etc.
- (v) White Out: A dangerous condition in winter when falling and drifting snow, or poor visibility cause the horizon to merge with the ground and the sky. It is difficult to orientate oneself. If one has to move under these conditions, it is best to rope up.
- (vi) Altitude: At high altitudes (especially over 6,500 (feet), endurance and concentration are reduced. Cut down on smoking and alcohol. Sleep well, acclimatize slowly, stay hydrated, and be aware of signs and symptoms of high-altitude illnesses.

II. SUBJECTIVE HAZARDS:

The Subjective hazards are the human caused incidents, such as climbing above the ability of the mountaineer, dehydration, overexertion etc.

- i. Falling: Falling can be caused by carelessness, over-fatigue, heavy equipment, bad weather, over estimating one's ability, a hold breaking away, or other reasons.
- ii. Camp Site: Bivouac sites must be protected from rock fall, wind, lightning, avalanche run-out zones, and flooding (especially in gullies).
- iii. Equipment: Ropes are not total security; they can be cut on a sharp edge or break due to poor maintenance, vintage, or excessive use. One should always pack emergency and bivouac equipment.

HEALTH HAZARDS - MOUNTAIN SICKNESS:

Improper acclimatization poses many problems for climbers, facilities and supplies may be inadequate to treat all victims. Mountain sickness and other illness may also occur. Evacuation of the sick and wounded is compounded by the terrain and harsh weather conditions. The most course of action is to provide first aid as early as possible.

Health Hazards: The mountaineers climb up in high mountains, their body has to face various mountain sickness or health problems at the high altitudes due to, less oxygen, low atmospheric pressure, high wind velocity, increased intensity of cold and isolation etc. The stage of changes in human body is called "Acclimatization stage", which causes mountain sickness. The following are the main mountain sickness,

- (i) **Hypothermia:** It is generalized cooling of body caused by exposure to extreme cold. It occurs when a person's core body temperature drops below 95 degrees Fahrenheit (35* C). with severe hypothermia, the core body temperature can drop below 86 degrees.

Causes: Health issues and certain medications can affect the body's ability to regulate itself when cold. Medications which affect thermoregulation include: -

Stages of Hypothermia:

Temperature	Stage	Symptoms
97 °F to 99 °F (36.1° to 37.2 °C)	Normal Body temperature	
90 °F to 95 °F (32 °C to 35 °C)	Mild Hypothermia	Shivering, Goose bumps, Bluish skin, Confusion, Trouble speaking, Memory problems.
82 °F to 90 °F (28 °C to 32 °C)	Moderate Hypothermia	Shivering stops, Sleepiness, Seeing things that aren't there. (Hallucination)
Less than 82 °F (28 °C)	Severe Hypothermia	Stiffness, Loss of consciousness or Coma, Breathing stops, heart stops.

Prevention:

- a. Eat a healthy meal which will provide enough calorie to generate heat in the body.
- b. Eat snacks periodically to maintain calorie level.
- c. Have warm non- caffeinated beverages.
- d. Do not sit on cold items.
- e. Keep moving as much as possible.
- f. Wear appropriate clothing for insulation.
- g. Keep clothing dry.
- h. Cover Mittens, gloves, hats, scarfs, and ski masks help the body to keep heat intake.
- i. Move the person to a warm, dry shelter as soon as possible.
- j. Remove any wet clothing.
- k. Protect the person against the wind, drafts, and further heat loss with warm, dry cloths and blankets.
- l. Begin rewarming with extra cloths and warm blankets.
- m. Hot packs or heating pads should be avoided as these can cause burns to the skin.
- n. Take the persons temperature if possible.
- o. Offer warm beverages if the person is able to drink.
- p. Avoid alcohol and caffeine, which speed up heat loss.

q. Do not briskly rub or massage the person's extremities as with severe hypothermia; this muscle activity can cause the heart to stop. Strenuous muscle activity should also be avoided.

ii. **Frostbite:** Frostbite occurs when tissues freeze. This happens because in cold weather, the blood vessels become narrow which reduces blood flow and oxygen to the tissue. Frostbite usually affects body part that are farther away from the body core, and therefore, normally, have less blood flow. These includes your feet, toes, hands, fingers, nose and ears.

Signs and Symptoms of Frostbite.

- a) The areas affected feel cold and firm.
- b) Sensations of burning, tingling, stinging, or numbness.
- c) Clumsiness can occur due to loss of motor control.
- d) When the affected body part is rewarmed, a throbbing or burning pain may be felt.

Treatment.

a. Frostbite requires immediate treatment, ideally in a medical facility. Before transporting to a medical facility, the affected area should be gently and loosely wrapped in a dry sterile bandage or clean blanket to prevent further trauma.

The most effective treatment is rapid rewarming which may be accomplished by immersion of the affected area in a tub of lukewarm water that is between 40-42°C for 20 to 40 minutes or until thawing is complete. Warm wet packs can be used if a tub is not available.

(ii) **Chilblains:** It is a cold injury which occurs due to excessive exposure of body parts to extreme cold. Chilblains also occur due to an abnormal vascular response several hours after the that was exposed to the cold is re-warmed. Persons are more at risk for getting chilblains if they use nicotine or other drugs that reduce blood flow to the extremities.

Symptoms.

- a. Itchy,
- b. painful,
- c. reddish or purplish areas of swelling usually affecting fingers, toes, nose or ears.
- d. Blisters or small open sores may develop, symptoms that last for several days.

After healing, the area may be very sensitive to cold in the future

Trench foot is named after the condition suffered by soldiers in the trenches during the World War I. It develops after a prolonged exposure to a wet, cold environment and is more serious than chilblains. Tight fitting boots or shoes can exacerbate the condition. Trench foot does not require freezing conditions but can occur at temperatures up to 15°C.

Symptoms.

- a. Itching.
- b. Numbness.
- c. Swelling.
- d. Red, blotchy skin or blue-black with advanced injury.
- e. Blister and open sores can develop.

- f. With severe trench foot, the tissue dies and falls off. Gangrene can develop and the foot may need to be amputated.

Frostnip.

Frostnip occurs in mild cold weather and usually affects the face, ears, toes, and fingers. Symptoms appear after exposure to cold weather.

Symptoms.

- a. Pale appearance of the skin.
- b. Burning, itching or pain.
- c. Tingling and numbness.

Treatment. Simple rewarming restores the normal color and sensation with no permanent tissue damage.

Prevention of Cold Injuries.

Cold injuries can be prevented if you are prepared when out in cold weather.

- a. Avoid staying out in the cold for long periods of time.
- b. Dress warmly and in layers.
- c. Head for a shelter that will protect from wind or rain if you are wet or cold.
- d. Avoid activities that cause increased sweating.
- e. Increases heat loss through evaporation and will cause you to feel cold.
- f. Avoid touching metal, especially with wet hands, because it will make you feel colder and may cause frostbite.
- g. Avoid drinking alcoholic beverages because alcohol: -
 - i. Interferes with the body's ability to regulate body temperature.
 - ii. Affects judgment.
 - iii. Can cause blood vessels in the skin to dilate and thus increase heat loss.
 - iv. Reduces the body's ability to sense cold because it depresses the nervous system.
 - v. Avoid drinking caffeine or smoking while out in the cold.
 - vi. Nicotine (from tobacco) and caffeine cause narrowing of the blood vessels in the hands and feet. When vessels are narrowed, less blood can get to those areas causing the hands and feet to become cold.

Snow Blindness.

It is a burn to the cornea from over exposure to ultraviolet (UV) light. Snow is highly reflective and can reflect up to 80% incident UV radiation.

Symptoms.

- a. Feeling of grit in eyes.
- b. Increased tear production.
- c. Uncontrolled twitching of eyelids.
- d. Redness.
- e. Pain.
- f. Distorted vision (halos, blurriness).
- g. Light sensitivity.
- h. Swelling.
- i. Temporary loss of vision.

Prevention.

- a) Use sunglasses or goggles which are rated for 99-100% UV abortion.

- b) They should be wrap around or side shielded with large lenses that fit close to the face.
- c) Make sure you have appropriate eye protection, even on overcast days.

Treatment.

- a) If you experience this, remove yourself from exposure by going into a darkened room or tent.
- b) Remove contact lenses until your eyes return to normal.
- c) Apply a cool compress to your eyes. Manage pain with over-the-counter medication.

Acute Mountain Sickness.

(a) New entrants to high altitude areas comprise mainly tourists, trekkers mountaineers, porters, workers, soldiers etc. The entry of these un- acclimatized individuals along with native highlanders who re-enter high altitudes after moving down or ascending up further from native heights render them liable to Acute Mountain Sickness (HA) ranging from Benign Acute Mountain Sickness to life threatening or fatal disorders like acute high Altitude Pulmonary Oedema (HAPO) or High-Altitude Cerebral Oedema (HACO).

(b) Environmental Factors.

- (i) Decreased partial arterial pressure of oxygen (PaO₂). It falls further due to hypoventilation in sleep leading to tissue hypoxia.
- (ii) Cold temperature, high wind velocities and resultant drop in humidity of air. All these lead to dehydration due to increased insensible loss of water from body.
- (iii) Increased ionizing and non-ionizing radiations.
- (iv) Lowered bariatric pressure which is directly proportional to high altitude, is a major factor responsible for acclimatization and development of acute mountain sickness.

Clinical Presentation	Management	Prevention
<p>Mild Acute Mountain Sickness Headache with nausea, dizziness and fatigue during first 12 hrs after ascent to high altitude (> 3000 M).</p>	<p>Descend 500 M or more, rest and acclimatize; or speed acclimatization</p>	<p>Ascend at a slow rate; spend a night at an intermediate altitude, avoid overexertion; avoid direct ascent to an altitude of more than 3000M</p>

<p>Moderate Acute Mountain. Sickness- moderate to severe headache with marked nausea, dizziness, lassitude, insomnia and fluid retention at high-, altitude lasting for 12 hrs or more.</p>	<p>Descend 500M or more; if descent is not possible, use a hyperbaric chamber or administer low-flow Oxygen (1-2 lts/min); if descent is not possible and Oxygen is not available, administer Acetazolamide (250 mg BD).</p>	<p>Ascend at a slow rate; spend a night at an intermediate altitude; avoid overexertion, avoid direct ascent to an altitude of more than 3000 M.</p>
<p>High-Altitude Cerebral Oedema (HACO) Acute Mountain Sickness for 24 hrs or more, severe lassitude, mental confusion, ataxia.</p>	<p>Initiate immediate descent or evacuation; if descent is not possible, use a portable hyperbaric chamber; administer Oxygen (2-4 lts/min).</p>	<p>A void direct transport to an altitude of more than 3000 M; ascend at a slow rate; avoid overexertion; consider taking.</p>
<p>High-Altitude Pulmonary Oedema, (dyspnea) (HAPO) Moist cough, severe weakness, drowsiness, Cyanosis, Tachycardia, Tachypnoea Rales.</p>	<p>Administer Oxygen (4-6 lts/min until condition improves, and then 2-4 lts/min to conserve supplies). Descend as soon as possible with minimal exertion, or use a portable hyperbaric chamber.</p>	<p>Ascend at a slow graded rate; avoid overexertion; people with earlier episode should avoid high altitude areas.</p>

(iv) High altitude Pulmonary Oedema (HAPO): It causes due to moisture accumulation in the lungs. it is an acute, dramatic and sometimes life-threatening condition seen in un-acclimatized persons. The best treatment is to evacuate the patient to lower heights and give oxygen immediately. Hyperbaric chamber is also very effective while counter the attack.

(v) High altitude Cerebral Oedema (HACO): The primary cause of HACO is hypoxia (oxygen deprivation). The Brain swells with fluid because of the physiological effects of climbing to high altitude before acclimatizes.

(vi) Acute Mountain Sickness (AMS). AMS is caused by diminished oxygen pressure in the atmosphere, and hence in the blood, and strikes those falling to adapt to high altitude.

(viii) Sun Burns. It occurs due to overexposure to sunrays and ultraviolet rays over high mountains. Sun burn can be of two types i.e. superficial and deep.

Psychological Hazards:

These consists of over confidence, leading to foolhardiness, taking uncalculated risks is not sign of showing courage. Bravado egoism, a false sense of national prestige. Deliberate attempts at floating safety regulations should be frowned upon and never be encourage.

Discussion:

Dr. Akpay Sarybaev, International conference on chronic hypoxia, 2012, studied about the heart rate variability in acute mountain sickness (AMS) and to develop the method which predicts the AMA.

Dr. GR Zubieta -Calleja, International conference on chronic hypoxia, 2012, expressed that an adequate Acid- Base balance is probably the fundamental metabolic adaptation that allows for mountaineers to tolerate extreme hypoxia and even reach the summit of Mt. Everest.

Dr. Charanjeet Kaur, International conference on chronic hypoxia, 2012, narrates that Hypoxia associated with many clinical conditions, induces disruption of the BBB (Blood-brain & Blood) resulting in vascular leakage, glial cell swelling and formation of edema.

Dr. Nazan Dolu, ICCH 2012, Discovered some hematological changes in the mountain climber. These changes elevated serum ferritin concentrations may be an adaptive mechanism of prolonged physical activity.

Col. G. Himashree, ICCH 2012, found that Yoga practitioner group showed a significant reduction in serum cholesterol triglycerides, low density lipids, very low-density lipids and blood urea. Yoga is an effective modality to improve health and performance in high altitude and should be included in the regular curriculum of the soldiers deployed in HA.

Conclusion

The tiny human cannot fight against the Mother Nature. All the problems and symptoms start beyond a height of 12000 ft. Lack of knowledge about mountains can be a cause for mishaps and failure of operation. Therefore, it becomes imperative for a mountaineer to know all the problems he is likely to face while in mountains. Mountains should not be treated casually, carelessly or with contempt.

As more and more mountaineers take to yoga and spirituality, many have started dreaming of reaching Mt. Everest by practicing yoga. Yoga isn't just about asanas or body postures. Yoga and Spirituality make for a winning combination. Recent studies have found that Yoga factors often play an important part in the careers of top Mountaineers. Mountaineers could benefit

tremendously from spiritual practices like yoga, Pranayama and meditation. Such practices not only calm the mind it increases focus, energy level, flexibility, quick and positive decision making, increase the vital capacity, but also bring greater self-confidence, better bonding and leadership, and less anxiety and fear. Breath is the most powerful tool while scaling Mt. Everest. At that altitude, being able to breathe isn't easy and Art of Living techniques prepare one for that, resilience and control over breath is a must. The breathing techniques, called the Sudarshan Kriya in particular, really helped the mountaineers when they were gasping for breath at extreme altitudes.

The “spirit of adventure” which is a must for operating in high altitudes, can be achieved by Mountain training.

It is not the mountain we conquer but ourselves.

-Sir Edmund Hillary

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