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PHYSIOLOGICAL CHANGES AT HIGH ALTITUDE: A CRITICAL REVIEW

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ABSTRACT

Human movements in extremely hostile environment like humid costal areas, frigid high altitude lead to detrimental physiological effects. It is unavoidable due to military, sports, piligrimages and tourism activities. High altitude is one of the most extreme environments creating challenges to human survival and performances. Travel to high altitude exposes the human body to a variety of stresses, the most prominent being reduced oxygen level with increase in altitude due to reduced partial pressure of oxygen. The physiological changes like hypoxic ventilatery response, diueresis, increased cardiac output, improved oxygen carrying capacity and cerebral blood flow etc. occurs during high altitude exposure. This article reveals basic framework mentioned above.

INTRODUCTION

High altitude physiology includes hypoxia diuresis, acclamtization, high altitude pulmonary odema, hypoxic pulmonary vasoconstriction.so journey to high altitude are common for adventure and recreational purposes. Too rapid ascent or inability to acclimatize leads to high altitude illness. These includes acute mountain sickness and high altitude pulmonary odema. gradual ascent to a high altitude leads to a series of adaptive changes in the body, termed as acclamtization, these includes changes in the respiratory, cardiovascular, hematologic systems and cellular adaptations that enhance oxygen delivery to the tissues. High altitude cerebral odema and and high altitude pulmonary odema each year millions of people travel to high altitude visiting recreation areas in the himalyas in asia, rockies in the united states and andes in south America. In addition, every year thousands of adventures scale the highest

peaks in the World, testing the limits of human endurance. Human body is specially designed in such way that it delivers adequate oxygen to the tissues only when oxygen is supplied at a pressure close to sea level so at high altitude there is hypoxic hypoxia. Key points of studying high altitude physiology is hypoxia, expansion of gases, fall in atmospheric temperature, and light rays. The French physiologist Paul bert first recognized that harmful effects of high altitude are caused by low oxygen tension. This article describes about the air pressure changes in high altitude, physiological effects of low air pressure on the body, and pathology that can arise from low air pressure environment.

Elevation (meters*)	Altitude	Pressure (mmHg)	PIO_2 (mmHg)	Effects
0-500	*Sea level*	760-743	159-155	Normal
500-2,000	*Low*	743-604	155-126	Minor impairment in performance
2,000-3,000	*Moderate*	604-537	126-112	Altitude illness appears; acclimatization is increasingly important
3,000-5,500	*High*	537-394	112-82	Considerable decline in performance; altitude illness and acclimatization are clinically important
>5,500	*Extreme*	<394	<82	Prolonged exposure leads to progressive deterioration (Zone of Death 8,000 m)

1. Expansion of gases
2. Fall in atmospheric temprature
3. Light rays

1}Hypoxia: Classification

1. Hypoxic hypoxia
2. Anemic hypoxia.
3. Stagnant hypoxia
4. Histotoxic hypoxia

Hypoxic hypoxia: Oxygen pressure in the blood going to the tissues is too low to saturate the hemoglobin.

Anemic hypoxia: The amount of functional hemoglobin is too small, and hence the capacity og bllod to carry oxygen is too low. when hemoglobin saturation falls bellow 60percent serious cellular dysfunction occurs and if prolonged, can cause death.

Stagnant hypoxia: Blood flow through the capillaries is insufficient to supply the tissues.

Histotoxic hypoxia: The cells of the body are unable to use the oxygen, although amount of blood may be normaland under normal tension.

Character and degree of hypoxic effects with increasing altitude depends upon.

1: level of the altitude

2: Rate of ascent.

3: Duration of exposure at high altitude

Immediate effects

A}Due to hypoxia their is stimulation of juxtraglomerular appartus of kidney which in turn increases the erythropoetin secreation.then stimulates red bone marrow, their is improvement in the RBC caunt and oxygen carrying capacity of blood.

B}On CVS

1. Vascularity in body increases
2. Blood flow to vital organs increases.
3. Heart rate and cardiac output increases

C}On respiratory system

1. HAPE, high altitude pulmonary odema :symptoms of HAPE starts within the first 2 to 4 days at altitude. Its life threatening form of non cardiogenic fapulmonary odema due to leaky cappilaries. earliest symptoms are shortness of breath with exercise, may propgress to severe shortness of breath even at rest, a persistent cough sometimes with blood, chest tightness, severe weakness. If untreted progress to a coma and death. in order to compensate pulmonary problems its ventilation increases upto 66per due to increase in pulmonary blood flow so diffusing capacity of alveoli increases and leads to pulmonary odema.

D}On GIT: Due to high altitude following symptoms occurs.

a. Loss of appetite
b. Nausea

c. Vomiting
d. Dyspepsia
e. Flatulence
f. Diarrhoea
g. Peptic ulcer
h. Gastrointestinal haemorrhage
i. Malnutrition due to hypoxia
j. Neonatal hyperbilirubinemia.

E} on kidney; natriuresis with pottasium bicarbonate excretion to compensate the respiratory alkosis. their is polycythemia, hyperurecemia in order to compensate respiratory alkosis.

F}On CNS

a}HACE, I.e high altitude cerebral odema

Mechanism:due to low partial pressure of oxygen causes arteriolar dilation which is normally compensated by cerebral autoregulation, once the limit of cerebral circulation autoregulatory mechanism is reached, there occurs an increase in capillary pressure. It favours inreaased transudation of fluid into brain tissue.

b} High altitude retinopathy: retinal odema, tortuosity and dilation of retinal veins, disc hyperemia, retinal hemorrhage, raerely cotton wool exudates. their may be retinal hemorrhage, macular hemorrahges, but can resolve spontaneouslyb in 10to 14 days.

2}Effect of expansion of gases: according to boyles low of gases pressure is inversaly proportional to volume of gas. and at high altitude due to decrease in barometric pressure, volume of all gases increase in atmospheric air as well as in the body. expansion of gases in the gastrointestinal tract causes painful distension of stomach and intestine.

3}Effect of fall in atmospheric temperature:at every 1000ft increase in altitude their is decrease in temperature by 2degree. its effect also depend on wind velocity and humidity. environmental temperature falls gradually at high altitude. injury due to cold or frostbite if the body is not adequately protected by warm clothes.

4}Effect of light rays: the ultraviolet rays that penetrates our skin is made up of two types of radiation uvA rays and uvB rays which is harmful for skin.

ACUTE MOUNTAIN SICKNESS I.E AMS: AMS usually occurs above 8000 ft. it is caused by reduced air pressure and lower oxygen levels at high altitudes. the symptoms of AMS are sleeping difficulty dizziness, fatigue, headache, loss of appetite, nausea, vomiting, rapid pulse and shortness of breath with exersion.

DISCUSSION

This article focus on the acute and chronic effects of altitude exposure as occurs in tourists, trackers, mauntaineers. As altitude increases pressure falls and the environmental partial pressure of inspired oxygen decreases,with consequent ambient hypoxia. Another most common syndrome is acute mountain sickness which usually begins within a few hours of ascent. At high altitude persons have to face " hypoxia" as major problem. secondly it creates expansion of gases and reasults into various health problems and also there is fall in temperature which creates cold injury or frost bite etc.

CONCLUSION

At high altitude health issues occurs mostly due to Hypoxia, pressure changes, fall in temperature, light rays. So people exposing to high altitude should know all physiology of high altitude. So they can take necessary precausions to prevent pathology occuring at high altitude.