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Original Article

Ocular Presentations in High Altitude Sickness: Experience of Our Centre

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ABSTRACT

Introduction: High altitude has various effects on human beings. Altitude related illnesses are a frequent cause of morbidity and occasional mortality in travelers to high altitudes throughout the world. Altitude has potential undesired ophthalmological effects too. Most of these problems are primarily preventable with an adequate level of information before and during travel. In this article, ophthalmological effects like altitude retinopathy and other ocular presentations of high altitude, likely to be encountered by mountaineers, are reviewed.

Materials and methods: This is a hospital based cross-sectional study from March 2016 to March 2017 done in Swacon International Hospital and Sleep Care Center, Kathmandu, Nepal. All the patients diagnosed as acute mountain sickness in the hospital during the study period were included. All the patients were evaluated by a physician and an ophthalmologist. All the findings were recorded in the proforma.

Results: A total of 167 patients were admitted. Among them 98 patients were diagnosed of acute mountain sickness; 20 patients had High altitude cerebral edema and 40 had High altitude pulmonary edema. Ocular findings, among patients who presented to our centre, were high altitude retinopathy (28.48%) corneal abrasions (5.6%), snow blindness (8.86%) , acetazolamide induced myopia (2.53%), conjunctivitis(8.22%), corneal ulcer (1.26%) and retinal detachment(0.63%).

Conclusions: Mountaineers are at risk of developing high-altitude-related illnesses. Many other tissues in the eyes are also affected by high-altitude hypoxia, and effects can be observed on the conjunctiva, cornea, intraocular pressure, lens, uvea apart from retina and the optic nerve.

Keywords: Retinal hemorrhages; High altitude retinopathy; High altitude cerebral oedema; High altitude pulmonary edema; Retinopathy

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INTRODUCTION

High altitude has various effects on human beings. Altitude sickness[1] is a syndrome consisting of four clinical entities, any one or more of which may be present in varying degrees. The subdivisions are acute mountain sickness (AMS), high-altitude cerebral edema (HACE), high-altitude pulmonary edema (HAPE) and high-altitude retinopathy (HAR). High altitude cerebral edema and high altitude retinopathy are the conditions commonly seen in mountaineers and people who are introduced to high altitudes without proper acclimatization.[2] Acute mountain sickness, HACE and HAPE three life threatening conditions seen in persons who fail to get acclimatized to the hypobaric hypoxic condition. High altitude retinopathy, though a benign condition as compared to HACE and HAPE, can cause visual impairment in these patients. In diagnosing and analyzing these entities, the recognition of the signs and symptoms of each is indicated as follows.

The development of AMS presents with lethargy, nausea,

headache, insomnia, anorexia, and disorientation. It is precipitated by inadequate acclimatization, rapidity of ascent, and high altitude. Progressive, severe headache is the hallmark of HACE, followed by impaired cortical function and judgment, irrationality, projectile vomiting, diplopia, ataxia, depressed sensorium, and coma.[1] High altitude pulmonary edema may be rapidly life- threatening. Diagnostic signs are tachypnea, dry cough, blood-tinged sputum, tachycardia, cyanosis, and moist rales, with respiratory failure imminent.

High altitude retinopathy is a pathological entity documented in individuals exposed to high altitudes. They demonstrate retinal hemorrhages, optic nerve edema, or both, and in at least one case, new cotton wool spots.[3-7] While not absolute, these abnormalities generally have resolved upon return to sea level.

Ascent to high altitude is well known to induce characteristic changes in the posterior segment. Vascular engorgement and tortuosity as well as disc hyperemia have been observed in individuals at an altitude of at least 16,400 feet and are considered to be normal responses to the hypoxic environment,[6] Knowing at what altitude these changes are first observed is difficult, but they have been documented as low as 10,800 feet above sea level.[7]

Many other tissues in the eyes are affected by high-altitude hypoxia, and effects can be observed on the conjunctiva, cornea, intraocular pressure, lens, uvea as well, apart from retina and the optic nerve and these effects are frequently encountered by mountaineers around the world. This study was carried out to find out how common is altitude retinopathy in patients of acute mountain sickness and what could be other ocular problems encountered by people going to high altitudes.

MATERIALS AND METHODS

This is a hospital based cross-sectional study from March 2016 to March 2017 done in Swacon International Hospital and Sleep Care Center, Kathmandu, Nepal. Permission was obtained from the ethical committee of the hospital. All patients rescued from the high altitudes and presenting as acute mountain sickness, diagnosed by Lake Louis acute mountain sickness score (with symptoms of headache, gastrointestinal symptoms, fatigue, dizziness)[8] were included in the study. They were first examined by the treating physicians, followed by ophthalmic examination. This included detail history and complete eye examination with dilated fundoscopy.

All the patients were evaluated by a physician and an ophthalmologist. Demographic data including age, sex, history of diabetes/ hypertension/other systemic and ocular diseases were collected in structured Performa after informed consent. Patients who had history of Diabetes, Hypertension or any other medical condition that could have caused retinopathy were excluded from the study.

Statistical Analysis was performed using a statistical software package (SPSS 22 for windows).

RESULTS

We examined a total of 167 patients with high altitude illness in the period between March 2016 and March 2017. Among them, 9 were excluded from the study because they had other systemic diseases like diabetes/ hypertension which could have caused similar fundus pictures. Hence, a total of 158 patients were included, among whom 94 (59.49 %) were males and 64 (40.45%) were females. The age group ranged from 16 years to 74 years of age. Among 158 patients, 98 were diagnosed of AMS (58 males and 40 females); 20 patients had HACE (12 males and 8 females) and 40 had HAPE (24 males and 16 females). Patients presented with altitude sickness at the altitude higher than 2,500 meters (Table 1). These patients had various ocular symptoms. Blurring of vision was the most common symptoms (n=45; 28.48%) followed by ocular pain (Table 1)

Table 1 : Baseline characteristics of patient with high altitude sickness (n=158)

Age in yrs	40±18
Sex M/F	94 Male (59.49%) 64 Female (40.5%)
Altitude with symptoms (high altitude Illness)	
2,500 meters - 3,500 meters	10 (6.32%)
3,500 meters- 5,000 meters	45 (28.48%)
More than 5,000 meters	103 (65.18%)
Symptoms	
Dyspnea	40 (25.31%)
Cough dry	42 (26.58%)
Headache	98 (62.02%)
Dizziness	48 (30.37%)
Nausea/Vomiting	58 (36.70%)
Ataxia	35 (22.15%)
Blurring of Vision	45 (28.48%)
Photophobia	28 (17.72%)
Watering of eyes	24 (15.18%)
Redness of eye	24 (15.18%)
Ocular Pain	26 (16.45%)
Medications used	
Acetazolamide	80 (50.63%)
Dexamethasone	60 (37.97%)

Among 98 AMS patients, 28(28.5%) of them had haemorrhagic changes in the retina. Among 20 HAce patients, 12 (60%) had HAR. (Table 2) Similarly among 40 HAPE cases 5 (8.3%) had high altitude retinopathy

Table 2: Frequency of high altitude retinopathy in high altitude illness patients

	Patients with altitude retinopathy		Total
	Male	**Female**	45 (28.48%)
AMS	12	16	28 (17.72%)
HACE	10	2	12(7.59%)
HAPE	2	3	5(3.16%)

Papillodema was observed in 10 pateints (6.32%) diagnosed as HACE, of which 7 were male and 3 were female. Papilloedema was not seen in patient with AMS and HAPE.

Other common ocular findings among patients who presented with AMS were snow blindness (n=14; 8.86%) followed by conjunctivitis (n=13; 8.22%). The least common was retinal detachment seen in 1 (0.63%) case. Table 3

Table 3: Other ocular conditions without retinopathy

Ocular Conditions	Males	Females	Total
Acetazolamide Induced Myopia	3	1	4 (2.53%)
Conjunctivitis	5	8	13 (8.22%)
Corneal Abrasions	5	4	9 (5.69%)
Corneal Ulcer	2	0	2 (1.26%)
Retinal Detachment	1	0	1 (0.63%)
Snow Blindness	8	6	14 (8.86%)

DISCUSSION

High altitude cerebral edema and high altitude pulmonary oedema are two life threatening conditions seen in people ascending to a high altitude of more than 3048meters.[9] In our study, most of the symptoms of high altitude sickness started above 5000 meters in 103 patients (65.18%).

Among ocular conditions retinal hemorrhages, disc hyperemia, engorgement and increased tortuosity are the common retinal findings that have been described in patients ascending to high altitude. Leakage from retinal vasculature is seen; even in healthy individuals on ascend to high altitude due to hypoxia induced vascular changes.[4] Retinal hemorrhages were described even in individuals residing at high altitude by Singh et al.[2] Based on the number and extent of retinal hemorrhages, Weidman had classified high altitude retinopathy.[8]

Various theories have been described in the pathogenesis of high altitude retinopathy.[4,9,10] Hypoxia induced auto-regulatory mechanism, in retinal vasculature is the most widely accepted theory.[11] Deficiency in oxygen levels at high altitude leads to hypoxia, which induces various compensatory mechanisms in retinal circulation resulting in retinal hemorrhages.[12] Variation in haematocrit levels and increase in venous pressure due to raised intracranial pressure are other theories. In our study features of increased intracranial pressure as evident by papillodema were in 10 patients (6.32%) with HACE.

Though usually a benign condition, hemorrhages in premacular region can result in reduced visual acuity. The retinal changes are seen in 59% of patients with HACE[13] and in this study retinopathy were present in 28.48% patients. Brain edema develops due to hypoxia leading to vasogenic edema and rapid descend to sea level helps in fast recovery in these patients. Many other tissues in the eyes are affected by high altitude hypoxia, and effects can be observed on the conjunctiva, cornea, intraocular pressure, lens, uvea apart from retina and the optic nerve and these effects are frequently encountered by mountaineers around the world.

CONCLUSIONS

The anterior as well as posterior segments of the eyeball are affected by high altitude hypoxia. High altitude retinopathy is a common ocular manifestation. Many other tissues in the eyes are also affected by high-altitude hypoxia apart from retina and optic nerve and the effects can be observed on the conjunctiva, cornea, lens, intraocular pressure and the patients can present with corneal abrasions, snow blindness, acetazolamide induced myopia, conjunctivitis etc. Individuals ascending to high altitude may have multitude of ocular problems and so patients of acute mountain illness need to be carefully evaluated by an ophthalmologist along with the treating physicians.

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