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Fundus Changes at High Altitude Pulmonary Oedema

KEYWORDS: Fundus changes, RH, HAPE.

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ABSTRACT *Background: The prospective study was done to study the fundus changes in 253 consecutive admissions of high altitude pulmonary oedema (HAPE), at a tertiary care service hospital located at 11,000 ft.*

Methods: All were males and majority were serving soldiers with age group ranging from 12 to 45 yrs. All were acclimatised before being inducted to various HA posts. The soldiers were diagnosed with HAPE and were evacuated from various posts to this service hospital. Their complete ocular examination was done and fundus was examined with direct ophthalmoscope. The fundus photographs were taken with a Nikon NFC 50 camera. None of these cases had an history of Diabetes Mellitus or Hypertension.

Results: Incidence of abnormal fundi in HAPE cases were found to be 67% and these changes included venous engorgement with tortuocity, disc hyperaemia, papilloedema, retinal haemorrhages and neovascularisation. The incidence of retinal haemorrhages in HAPE was found to be 10.3%.

Conclusion: Apart from incidence of fundus changes in HAPE, an attempt was made to correlate the findings with various factors. It was found that fundus changes as a whole and Retinal haemorrhage (RH) in particular showed a direct correlation with altitude and with clinical severity of the illness. Fresh inductees to HA were as prone to develop these changes as the reinductees. The fundus changes were usually transient and reverted back to normal prior to discharge from hospital.

Introduction
Travel to an altitude of 2500 mts or greater puts people at risk of developing HA illness. This could be in form of Acute mountain sickness (AMS), High altitude pulmonary oedema (HAPE), High altitude cerebral oedema (HACE) and Chronic mountain sickness (CMS).

- AMS is generally milder and common form of HA illness. It is usually self-limiting and consists of a number of non-specific symptoms including headache, loss of appetite and nausea.
- More severe forms of HA illness include HAPE and HACE and these may lead to coma and death if left untreated.
- AMS and HACE are caused by hypoxia induced changes in blood-brain barrier leading to cerebral oedema and brain swelling.
- In HAPE exaggerated pulmonary hypertension leads to increased vascular permeability.
- AMS usually precedes development of HACE, whereas HAPE develops in first 2 to 4 days at HA and is not always preceded by AMS.
- HAPE is probably the leading cause of death at HA.

Humans are able to acclimatise to increasing altitude by:
- Increasing ventilation (via carotid body hypoxic ventilatory response).
- Increasing red blood cell production (via Erythropoietin).
- Increasing vascularity of lung and tissues.
- Suppression of Anti- Diuretic Hormone (ADH) and Aldosterone and increasing tissue mitochondria.

Materials and Methods:
- Comprehensive ocular examination was done if patient's condition permitted (same day or following day before pupillary dilatation).
- Fundus was examined with direct ophthalmoscope.
- Fundus was examined undilated on admission and following day after pupillary dilatation.
- Retinal haemorrhage was followed till it was absorbed.
- Fundus photograph was done by Nikon NFC- 50.
- Cases with Diabetes Mellitus and Hypertension were excluded from this study.

Results:
1.Fundus changes in HAPE was:
1.Venous engorgement with tortuocity
2.Disc hyperaemia
3.Papilloedema
4.Retinal haemorrhages and neovascularisation

Out of 170 cases, fundus changes were seen as Venous engorgement (164 cases), disc hemorrhage (73 cases), retinal hemorrhage (28 cases), papilloedema (13 cases) and neovascularisation (1 case).

2.Out of the total cases examined, the breakdown was as follows:
253 – Fundus examined of HAPE
194 – Were acclimatised
23 - Were smokers
- Were reinductees.

3.The severity of HAPE cases were of the following:
Mild – 47.4%

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Moderate – 43.9%
Severe – 8.7%

4.Altitude and incidence of HAPE relationship:

- At altitude <=12,000 incidence of HAPE was found in 207 cases
- At altitude <=18,000 incidence of HAPE was found in 28 cases
- At altitude <=12,000 incidence of HAPE was found in 16 cases

5. Age wise distribution and incidence of HAPE was:

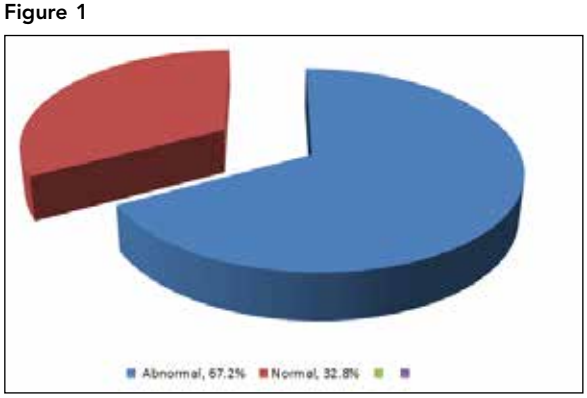
>=12 yrs were in 3 cases
13-20 yrs were in 13 cases
21-30 yrs were in 169 cases
31-40 yrs were in 49 cases
41-45 yrs were 19 cases

6. Out of the total inductees 82.2% were reinductees and 17.8% were fresh.

7. Induction Vs Fundus changes:

- In fresh inductees fundus changes were found in 73% and out of those 12% were having retinal haemorrhages
- In reinductees fundus changes were found in 60% and out of those 10% were having retinal haemorrhages

Fundus changes in HAPE:
Figure 1



Severity of HAPE vs Fundus changes:

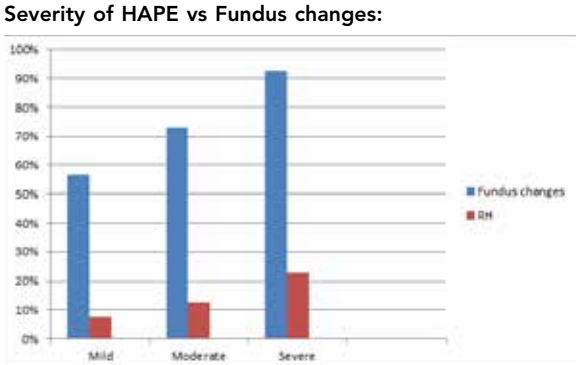


Figure 2
Fundus changes and retinal hemorrhage were more marked in severe cases of HAPE.

Height of onset vs Fundus changes:

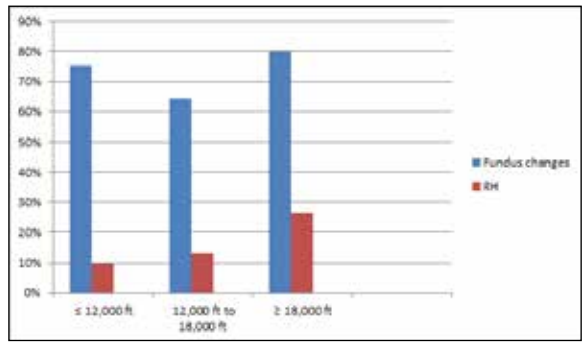


Figure 3

Papilleodema with Retinal Hemorrhage

Fundus examination of 253 HAPE cases showed papilloedema in 13 cases of 3-4 dioptres. Venous engorgement was seen in majority of cases. 28 cases showed flame shaped hemorrhage. With improvement of condition, the disc and retinal changes reversed back fully in 4 – 6 weeks of time.

Discussion:

Several reports [9-11]have discussed the pathogenesis of RH, suggesting causative role for increased retinal blood flow, dilatation of vessels in respect to hypoxia and increased venous pressure either caused locally by cerebral oedema or transmitted by coughing and straining changes in IOP have also been questioned. Some people take RH as a medical emergency[10]while some treat it as a common clinical sign without ominous implication [9]

For our observation RH is not necessarily a warning sign of treatment of HAPE as probably these are due to changes in increased blood flow and dilatation of vessels only.

Mc Fadden DM et al. showed 56% of cases had RH & 3% of "cotton wool spots" in their study of 39 cases who were examined after a stay at 16,080 ft [2].

In one of the series 53% of cases HAPE had retinal haemorrhage [3] whereas in our series 11% of HAPE cases had retinal haemorrhage.

In present study, retinal haemorrhage was much in incidence in severe HAPE cases and fundus changes and retinal haemorrhage were much common with higher altitudes.

The fresh and re-inductees showed the incidence of fundus

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changes and retinal haemorrhage almost equally.

Conclusion:

- Abnormal fundus was seen in approximately 2/3 rd of HAPE cases.
- RH incidence was 11% in HAPE cases. Abnormal fundus was in 16.5% of all HAPE cases.
- Abnormal fundus and RH correlated with severity.
- RH correlated with altitude in arithmetic progression.
- Fundus changes were transient and self-limiting.

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