

## Incidence of High Altitude Illness at Mt. Kailash Mansarovar (4500m), Tibet by Direct Helicopter Flight, A Cross-sectional Study.

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### Abstract

<b>Introduction</b>	Most of the pilgrims with their religious purpose would like to visit at Mt. Kailash Mansarovar 4500m or Gosainkund Lake (4300m). The high altitude illness is used to describe the cerebral and pulmonary syndromes that can develop in unacclimatized persons shortly after ascent to high altitude. High altitude illness usually occurs at altitude above 2500m. Sometime it may occur at the altitude of 1500m. This is mainly caused by hypoxia but is compounded by cold and with rapid ascent.
<b>Objectives</b>	To determine the incidence of HAI (High Altitude Illness) which include AMS (Acute Mountain Sickness), high altitude cerebral edema (HACE), high altitude pulmonary edema (HAPE) in pilgrims who fly directly then drive with a single overnight at Taklacoat and then Mt. Kailash - Mansarovar lake in Tibet (4500m) during the 2 <sup>nd</sup> day and returning back to Kathmandu on the 3 <sup>rd</sup> day.
<b>Methods</b>	Study of 37 pilgrims at Mt. Mansarovar with a close look at their clinical history, signs and symptoms and evaluated by the Lake Louise Consensus for AMS, HACE, HAPE.
<b>Results</b>	Out of 37 pilgrims, who flew directly from Kathmandu at 1300m to Simikot, Hilsa, Taklacoat and Mansarovar. 35.13 percent (13) of them developed high altitude illness. Among total 13 illnesses, 9(24.32%) were affected with AMS and 4(10.81%) with dangerous early HAPE. There was no gender difference for AMS and HAPE. Younger ages were more susceptible for AMS as well as those who took a holy dip in the lake. Such persons developed more chances of having HAPE. Using Lake Louise criteria showed that the incidence of AMS was higher and that of HAPE was lower among high altitude illness. Those who flew directly with a drive on the 2 <sup>nd</sup> day to Mansarovar Lake were found to have a higher incidence of AMS, but fewer cases of HAPE. These results were found in spite of taking prophylactic Acetazolamide and Dexamethasone. Younger and elderly age groups were found to be more susceptible.
<b>Conclusion</b>	There should be at least a 1-2 over night stay at an intermediate altitude, to help the body acclimatize and reduce unwanted medical problems. This way more and more elderly and younger pilgrim can visit such holy places.
<b>Keywords</b>	Mt. Kailash-Mansarovar Lake, High altitude illness, Incidence, Health problems.

### Introduction

As more pilgrims with their religious trekking purpose, would like to visit Mt. Kailash Mansarovar 4550m or Darchen (4700m) or Gosainkund lake (4300m) or Lhasa (3685m)<sup>1,2</sup> or even Mt. Everest Base Camp (5800m), the high altitude sickness is increasingly becoming a problem that family physicians (general practitioners) across the country have to treat in the modern age of hiking and trekking in alpine area. High altitude illness usually occurs at altitude above 2500m (sometime in 1500m). This is mainly caused by hypoxia but is compounded by cold and exposure with rapid ascent.

High Altitude Illness (HAI) presents mainly in the forms of: Acute Mountain Sickness (AMS), High Altitude Cerebral Edema (HACE) and High Altitude Pulmonary Edema (HAPE).

Definition of High Altitude illness:- AMS will manifest within 4-36hrs<sup>3,4</sup> or 6-12hrs of ascent to altitude 2500-3000m. Symptoms may not appear till for time after ascent. If no further altitude gain is made, these symptoms usually resolve within 24-72hrs. High Altitude Cerebral Edema (HACE)<sup>1,4</sup> usually occurs with

1–3 days. Sometimes it progresses from mild AMS with in 12hrs also. It is an end stage of severe AMS in the event of rapid rise in altitude, either with a presence of a change in mental status/or catwalk. Symptoms of HACE are also worst at night. Once coma has developed, mortality is over 60 percent<sup>1</sup>.

High Altitude Pulmonary Edema (HAPE)<sup>1,3-5</sup> usually occurs within 2–4 days of ascent to altitude more than 2500m, most commonly on the second night. It is non-cardiogenic pulmonary edema associated with pulmonary hypertension. It is most common cause of fatality due to high altitude. Up to 15 percent of Indian soldiers develop this syndrome when air lifted from sea level to altitudes between 3500m – 5500m. Younger person's i.e. less than 20yrs of age are more susceptible.

## Methodology

A cross-sectional descriptive study was conducted. Target population were the pilgrims who wanted to directly fly from Kathmandu to Simikot, Hilsa (border of Nepal) followed by short land route to Mt. Kailash Mansarovar. Total 37 pilgrims, out of that, 3 of them were Nepalese (8.1%), including myself and managing director of Society travel. Rest of other 34 pilgrims (91.8%), first came directly from Comboitor sea level to Kathmandu (1300m) overnight stayed in hotel. Next day, they were directly flown by helicopter from Kathmandu (1300m) to first Simikot (2970m), then to Hilsa (4400m). After that we went to the Sher (border of Tibet) within 45 minutes, then to Taklacoat (4400m) by land cruiser within one and a half-hour drive and stayed there for 12 hours. Next morning we went directly to Mansarovar Lake (4550m). After 5-6 hrs of rest and having good meal, half of them took holy dip in the Lake. We went close to Mt. Kailash base, Darchen (4755m) and came back. On 3<sup>rd</sup> day 34 people of them came back to Taklacoat, then to Hilsa by motor vehicle and they flew back to Kathmandu.

They all stayed in one of the hotel in Kathmandu during their arrival night. One expert doctor took a class on awareness of early feature of acute mountain sickness. He made a deep stress upon the danger feature of complications and highlighted the importance of taking Acetazolamide 125mg, twice day at least 24 hours prior to Simikot, and its side effects. Because of his effective lecture, most of the pilgrims made prompt response on very early feature of sickness, thereby making the possibility of reducing morbidity. All the pilgrims have been explained the Lake Louise Consensus Scoring of

Acute Mountain Sickness-Self assessment chart Canada<sup>3,5-7</sup>, which deals in following headlines: There must be headache (mild 1, moderate 2, and severe 3), along with at least several hours' stay at the new altitude with recent gain in altitude.

*With at least one of the following symptoms<sup>5,8</sup>.*

1. Weakness or fatigue (mild 1, moderate 2, severe in incapacitating 3)
2. Gastrointestinal symptoms: Anorexia (poor appetite) 1 – nausea (tendency to vomit) 2, vomiting 3
3. Dizziness or light headedness (mild 1, moderate 2, severe incapacitating 3)
4. Sleeping – Did not sleep as usual 1, woke many times/poor night sleep 2. - Could not sleep at all 3. A score of 3 or more with headache and one other symptom is positive of AMS<sup>6</sup>.

As soon as patient complains of any problem, then try to co-relate with a scoring of chart in step by step and find out the possibility of danger mountain sickness.

One has to look upon change in mental status of pilgrims, including normal 0, lethargy 1, confused 2, stupor 3 and coma 4. And for ataxia: no ataxia 0, difficulty in balancing 1, steps off line 2, falls down 3, cannot stand 4. The most sensitive indicator for HACE is ataxia and Tandem gait test is the best like catwalk. HACE doesn't affect finger to nose testing for Ataxia. When evaluating for diagnose high altitude pulmonary edema (HAPE)<sup>5,8</sup> at least two of the following symptoms should be present e.g.

1. Dyspnea at rest
2. Cough.
3. Weakness or decreased exercise performance.
4. Chest tightness or congestion.

*And at least two of the following signs should be present<sup>9</sup>:*

1. Central cyanosis
2. Audible Rales or wheezing in at least 1 lung field.(usually right middle lobe)
3. Tachypnoea > 20 per min.
4. Tachycardia >110 per min.

### *Inclusion Criteria*

Indian pilgrims aged 8-77 years residing of Comboitor (sea level), south India.

With the clinical evaluating fit for the travel, without having any contraindication of systemic disease. And taking prophylaxis of Diamox & than Dexona for allergy case<sup>10-11</sup>. All of them should visit Mt. Kailash

Mansarovar by direct helicopter flight with few hours of vehicle drive.

*Exclusion criteria*

Those who went to Mt. Kailash Mansarovar by walking, taking long duration more than three days and suffered with any uncontrolled health problems of diabetes, hypertension and COPD.

**Results**

There were 37 pilgrims - 21(57%) males and 16(43 %) females. Out of 37 study population, 13(35.13%) of them developed HAI. Among total HAI group, 9(69.24%) of them developed AMS, 4(30.76%) developed dry HAPE and none of them suffered by dangerous HACE in this study.

**Table 1: Relation of sex with high altitude illness (acute mountain sickness and pulmonary edema).**

Total numbers of Pilgrims 37				
Male 21(56.75%)			Female 16(43.24%)	
HAI 8(38.09%)		No HAI 13(61.90%)	HAI 5(31.25%)	
AMS		AMS		No HAI 11(68.75%)
HAPE		HAPE		
6(28.57%)	2(9.52%)		3(18.75%)	2(12.50%)

HAI – High Altitude Illness.  
AMS – Acute Mountain Sickness.  
HAPE – High Altitude Pulmonary Edema.

Above table 1 shows that 8(38.09%) of Male developed High Altitude Illness (HAI), among them 6(28.57%) developed Acute mountain sickness (AMS). Similarly 5 (31.25%) of females developed HAI, among them 3 (18.75%) developed AMS.

Table 2 shows the age distribution of HAI. It was found that age group (21-40) suffered very less with HAI compared to other age groups.

If we looked upon 37 study populations, they developed 9 (24.34%) AMS. Among them lake louise (LL) score 3 for AMS was 2(5.4%), LL 4-6 score was 5(13.51%) and LL 7-9 score was 2(5.4%) (Table 3).

**Table 2: Age in relation with sex in high altitude illness**

Age in Years	Total No Pilgrim	Males High Altitude Illness			Females High altitude Illness			Total High altitude illness
		Total Males	AMS	HAPE	Total Females	AMS	HAPE	
08-20	7	2	2	-	5	3	1	6(85.70%)
21-40	8	5	1	-	3	-	-	1(12.5%)
41-60	15	8	2	1	7	-	1	4(26.66%)
61-77	7	6	1	1	1	-	-	2(28.57%)
Total	37 (100%)	21 (56.75%)	6 (28.57%)	2 (9.52%)	16 (43.24%)	3 (18.75%)	2 (12.5%)	13 (35.15%)

**Table 3: Lake Louise score of acute mountain sickness & HAPE with age in years**

Age in Years	Total no Pilgrims	Positive (LLScore) AMS by Lake Louise score			Total AMS	HAPE	HACE	Total High altitude illness	Negative HAI
		LL Score 3	LL Score 4-6	LL Score 7-9					
08-20	7	1 (2.7%)	2(5.4%)	2(5.4%)	5	1(2.7%)	-	6(85.70%)	1
21-40	8	-	-	-	1	-	-	1(12.5%)	7
41-60	15	1 (2.7%)	2(5.4%)	-	2	2(5.4%)	-	4(26.66%)	11
61-77	7	-	1(2.7%)	-	1	1(2.7%)	-	2(28.57%)	5
Total	37 (100%)	2 (5.4%)	5 (13.5%)	2 (5.4%)	9 (24.32%)	4 (10.81%)	-	13 (35.13%)	24 (68.86%)

Table 4 (a) and (b) shows the general and GI symptoms of the people.

**Table 4(a) According to symptoms: - (Lake Louise Score)**

Symptoms	Mild	Moderate	Severe	Total
Headache	8	5	2	15
Fatigue , Weakness	8	3	1	12
Dizziness/ light headache	3	1	-	4

**Table 4(b)**

GI symptoms	No. of patients
Poor appetite/nausea	6
Severe nausea/little vomiting	1
Vomiting	6
Dyspnea at rest Chest tightness	4
Cough	4
Decrease exercise performance	3
Rales or wheezing	3
<i>Other symptoms</i>	
Rhinitis	3
Acute gastroenteritis	4
Gastric	7
Motion sickness	7
Claustrophobic	1
Backache	2
Whole bodyache	1

## Discussion

There was no significant difference observed between both the sexes in having HAI. It was found that out of the total population, 9 (24.32%) developed AMS and 4 (10.81%) suffered with HAPE, but none of them developed HACE in this study. Similar study was conducted<sup>12</sup> in the Himalayas wilderness environment. There were 68 percent who had AMS, 32 percent had HACE, and only 5 percent had HAPE. It was mentioned that 70-100 percent developed AMS if flown directly to 4268m<sup>13</sup>. So, most people can go up to 2438m with minimal effect, and they should start walking below 3048m<sup>14</sup>. If pilgrims go above 3048m, they should only increase the altitude by 305m per day and for every 915m of elevation gained; they should take 2 days rest. In one of the study it was mentioned that rapid ascent to altitude >5500m, even for brief exposures, might be associated with severe or fatal illness.

The AMS chart showed that the lower age group (8-20 years) was risky for AMS and indicated the possibility of the absolute problem among this group.

Similarly, in 8-20yrs age groups having total 7 cases, 6 of them suffered High altitude illness i.e. = 85.70 %.

Even at 2835m altitude, 28 percent children developed AMS<sup>5</sup>. The age group (21-40yrs), there was only 1 in 8 cases i.e. 12.5 percent suffered with AMS. That one had also minimum sickness only. So, it clearly showed that the safest age groups for the travel are between 21 to 40 years.

Out of total, 13 (35.13%) were suffered with HAI, among which 9(69.24%) suffered with AMS and 4 (30.76%) HAPE. When we measure in terms of total 37 pilgrims, on second day of night, those who dipped in Mansarovar Lake, 10.8 percent of them only developed early HAPE. In another study showed that 15 percent Indian soldiers develop HAPE when airlifted from sea level to altitudes between 3500m and 5500m<sup>5</sup>.

There were around 15 pilgrims (40.5%) who were involved in taking 3 times dipping in lake. But among them, 3 adult pilgrims only developed early HAPE. One child of 9 years, who did not undertake dipping, too developed the symptoms. The interesting thing is that those who were not involved in dipping did not develop HAPE at all. None of the other adult age groups were affected. So this study showed some relationship of dipping in Mansarovar Lake and Early feature of HAPE. Since the number of the pilgrims was rather small to

take into account as the conclusive evidence of the direct relationship of dipping in the lake with early feature of HAPE, further research with increased number of pilgrims is advisable. However, the present study warranted the need of some precaution in this respect.

Out of 37 pilgrims, 2(5.7%) of the people suffered with Sulpha allergy and took Dexamethasone (4 mg) 3 times a day in the Simikot only. Rest all of them took Diamox (Acetazolamide) 24hrs prior to flight. Total 5 pilgrims didn't take Prophylaxis of medicine initially. But after counseling of importance of the mountain-related problems, they took it on the day of arrival at Simikot.

Generally, most of the pilgrims went to the tour by land cruiser drive and walk, taking 20 days to reach lake and then come back. But there was no exact data published by any Journal about direct cases who flew to lake in 2<sup>nd</sup> day and came back on 3<sup>rd</sup> day. The situation therefore, warranted more and more study and confined to higher number of pilgrims.

## Conclusion

By using Lake Louise criteria, it showed that the incidence of AMS was higher and that of HAPE was lower among high altitude illness. Those who flew directly with a drive on the 2<sup>nd</sup> day to Mansarovar Lake were found to have a higher incidence of AMS, but fewer cases of HAPE. There were no cases of HACE in this study. These results were found in spite of taking prophylactic Acetazolamide and Dexamethasone. Two cases were found to be allergic to Diamox. Younger and elderly age groups were found to be more susceptible. Preventive measures need to be emphasized in these pilgrims. There should be at least 2 nights stay in Kathmandu (1300m), then further 1-2 nights stay in Simikot, followed by at least two nights stay at Taklacoat to make the possibility of reducing problems of AMS and dangerous HAPE, for the body to make acclimatized. Those who wanted to take dip in Mansarovar Lake must have preparation at least for a few days required to make the body acclimatized to reduce complication of dangerous life threatening HAPE.

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