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A STUDY ON AMS SCORING AND OXYGEN SATURATION (SPO2) OF AMARNATH YATRIS AT THE AMARNATH HOLY CAVE

Physiology

Dr. Rajendra Kumar Assistant Professor, Department of Physiology, Narayan Medical College & Hospital, Jamuhar, Sasaram, Bihar, India

Dr. Ashok Kumar Deo* Professor and Head , Department of Physiology, Narayan Medical College & Hospita,l Jamuhar, Sasaram, Bihar, India *Corresponding Author

ABSTRACT

Introduction: With increasing altitude, atmospheric pressure decreases while the percentage of oxygen in air remains constant that is about 21% and thus the partial pressure of oxygen decreases with altitude. Many Amarnath Yatris can ascend to 5000 to 6500 ft in one day without problems, but about 40% of those who ascend to 8000 ft and 80% of those who ascend to 10,000 ft develop AMS. The present study was designed with the aim to assess and correlate with AMS Scoring to oxygen saturation of Amarnath Yatris at the holy Amarnath cave.

Material and Methods: A total of 55 subjects of both male and female of five different age groups were taken. An informed consent was taken from each subject before the correlational study. Peripheral oxygen saturation (SpO_2) was measured with pulse oximetry while AMS Scoring of Amarnath pilgrims were done with Lake Louise AMS Scoring system.

Result: There was a significant decrease in Peripheral oxygen saturation (SpO_2) as compared to control as well as AMS Scores was increased.

Conclusion: In this study there was a significant decrease in Peripheral oxygen saturation (SpO_2) and increase in AMS Scores. Acute Mountain Sickness was present in all the subjects at the height of Amarnath cave and this was related with decrease in Peripheral oxygen saturation (SpO_2).

KEYWORDS

Peripheral oxygen saturation (SpO2), Amarnath pilgrims, acute mountain sickness (AMS), high altitude.

Lacs of Hindu devotees undergo an annual pilgrimage to the Amarnath cave across adverse cold hypobaric condition. During ascent for Amarnath Yatra in the mountains they experience multiple stresses like cold temperature, oxygen deficiency, sanitation problems, dehydration, severe exertion, but the stress unique to high altitudes is the oxygen-deficient atmosphere. Oxygen saturation is the fraction of oxygen saturated hemoglobin relative to total hemoglobin in the blood. The present study was designed with the aim to assess AMS Scores oxygen saturation of Amarnath Yatris at the holy Amarnath cave. Acute mountain sickness (AMS) is the commonest form of high altitude illness which is typically occurs in unacclimatized Amarnath Yatris ascending to altitudes more than 8000 ft, although it can be seen at lower altitudes in highly susceptible individuals. Lake Louise AMS score has provided a important tool for researchers to diagnose and to score the severity of AMS. With increasing altitude, atmospheric pressure decreases while the percentage of oxygen in air remains constant that is about 21% and thus the partial pressure of oxygen decreases with altitude. Many Amarnath Yatris can ascend to 5000 to 6500 ft in one day without problems, but about 40% of those who ascend to 8000 ft and 80% of those who ascend to 10,000 ft develop AMS. Rate of ascent, maximum altitude reached, and sleeping altitude leads to development of these disorders. Altitude sickness, the mildest form being acute mountain sickness (AMS), is caused by rapid exposure to hypoxia at high altitude[1] Acute mountain sickness, may present with a variety of symptoms like headache, loss of appetite insomnia, and nausea. However, in case of severe AMS confusion, difficulty walking, progressive cough, shortness of breath, and even death were seen in Amarnath Yatris. [2] Ascending slowly is the best way to avoid acute mountain sickness. Avoiding strenuous activity in the first 24 hours at high altitude reduces the symptoms of AMS. Fatty diets and sleeping pills or respiratory depressants slow down the acclimatization process and should be avoided. A fatty diet tends to cause diarrhea and exacerbates AMS. Thus, avoiding Fatty diets and sleeping pills consumption in the first 24–48 hours at a high altitude is optimal[3] Due to lack of oxygen at Amarnath cave R.Q. of Amarnath Yatris gets deranged resulting in gastrointestinal problems like Indigestion of food, diarrhea, vomiting and pain abdomen. Acclimatization is the process of adjusting Amarnath Yatris to combat hypoxia at higher elevations, in order to avoid acute mountain sickness [4]. Approximately at 10,000 ft Amarnath Yatris should take the "climb-high, sleep-low" approach. For Amarnath pilgrims a typical acclimatization regimen should be to stay a few days at a lower base camp for Yatris then climb up to a higher camp slowly and then return to base camp for night stay. A subsequent climb to the higher altitude then includes an overnight stay at lower base camp for Amarnath pilgrims. This process is then repeated a few times, each time extending the time spent at higher altitudes to let the body adjust to the oxygen level there, a process that involves the production of more RBCs. Once the Amarnath pilgrims have acclimatized to a given altitude, the process is repeated with camps placed at progressively higher elevations. The rule of thumb is to ascend no more than 1,000 ft per day to sleep. That is, one can climb from 9,800 ft to 15,000 ft in one day, but one should then descend back to 10,800 ft to sleep. This process cannot safely be rushed, and this is why Amarnath pilgrims need to spend days acclimatizing before climbing a high peak. Amarnath pilgrims should designed to allow partial pre-acclimatization to high altitude, reducing the total time required on the mountain itself[5] In most of the Amarnath Yatris dehydration was present probably due to the increased rate of water vapor lost from the lungs at higher Amarnath holy cave. This might be contribute to the symptoms of acute mountain sickness in Amarnath pilgrims.[6] The rapid ascent, altitude attained, amount of physical activity at high altitude, as well as individual susceptibility, were contributing factors to the onset and severity of high-altitude illness. High AMS scores were observed in almost all the Amarnath Yatris usually due to rapid ascent and could usually be prevented by ascending slowly.[7] In most of these cases, the symptoms were temporary and usually prevented with as altitude acclimatization.

MATERIAL AND METHODS:

The study was conducted in the department of physiology and Amarnath cave located in Jammu Kashmir, India in July 2014. This study was approved by the Ethical Committees of the institution, and written informed consents were obtained from all the Amarnath Yatris whom were agreed for study. A total of 55 subjects from Amarnath Yatris of both male and female of different age groups were chosen for this study. Diagnosis of AMS was based on the AMS Score and a rise in altitude within the last 4 days. Mild AMS were diagnosed when total AMS Score was 3–5 , moderate AMS Score was 6–9, and severe AMS on 10– 12 Score points. Although symptoms can develop within 6 hours of increase in altitude, we take for assessing AMS score only after 6 hours, to avoid confusing AMS with confounding symptoms from travel or responses to acute hypoxia.

Lake Louise AMS questionnaire	
A Headache	**Score**
No headache	0
Mild headache	1
Moderate headache	2
Severe headache	3
B Gastrointestinal symptoms	
No gastrointestinal symptoms	0
Poor appetite or nausea	1
Moderate nausea or vomiting	2

Severe nausea & vomiting	3
C Fatigue and/or weakness	
Not tired or weak	0
Mild fatigue/weakness	1
Moderate fatigue/weakness	2
Severe fatigue/weakness	3
D Dizziness	
Not dizzy	0
Mild dizziness	1
Moderate dizziness	2
Severe dizziness	3
E Difficulty sleeping	
Slept	0
Did not sleep as well as usual	1
Woke many times, poor night's sleep	2
Could not sleep at all	3
Total score	0 - 15

In 2014 approx 372909 Amarnath Yatris had darshan at holy cave. But due to bad weather and adverse condition our study was limited to 55 Yatris only. Pulse oximeter and Lake Louise AMS Scoring questionnaire was used for this study and method was pulse oximetry. Oxygen saturation (SpO_2) was measured by pulse oximetry which works by emitting and then absorbing a light wave passing through capillaries in the fingertip. AMS scoring was done with asking Lake Louise AMS Scoring questionnaire two times on 2hr intervals at the height of Holy cave (12756 ft).

RESULT:

There was a significant decrease in Peripheral oxygen saturation (SpO_2) as compared to control value as well as AMS Scores was increased at the height of holy cave (12756 ft). Control value for oxygen saturation was 98% and for AMS Score it was 0. Mean SpO_2 of Amarnath Yatris was 74.98 with S.D. of 11.0 at the altitude of 12756 ft. Mean AMS Score of Amarnath Yatris was 6.0 with S.D. of 1.5. AMS Scoring showed moderate acute mountain sickness (AMS). We found that acute mountain sickness (AMS) was related with decreased oxygen saturation. However some other causes may be associated for the mountain sickness. But our study found that AMS was associated with decreasing oxygen saturation in Amarnath Yatris during yatra.

Figure 1 showing Mean SpO_2 of Amarnath Yatris 74.98 with S.D. of 11.0 at the Holy cave

Figure 2 showing Mean AMS Score of Amarnath Yatris 6.0 with S.D. of 1.5 at the Holy cave

Minimum AMS Score was 4 which mean in all the subjects mild AMS were observed. Maximum score was 12 which reflect severe AMS. However mild to moderate AMS were seen in all the pilgrims at the holy Amarnath cave. In our study we found that above 55 years aged pilgrims developed AMS more than younger age groups. It was 6.9 in comparison to 5.6 in 15-24 years age groups. Rise in AMS Score and fall in oxygen saturation was similar in females like that of males.

Table showing mean SpO_2 and AMS score of 5 age groups of Amarnath Yatris at the holy cave (12756 ft)

15 – 24yrs		25 – 34yrs		35 – 44yrs		45 – 54yrs		55yrs – ABOVE	
SpO_2	AMS	SpO_2	AMS	SpO_2	AMS	SpO_2	AMS	SpO_2	AMS
75.9±4.78	5.6	79±3.92	5.0	74.5±4.92	5.9	75.6±3.58	06	69.8±23.54	6.9

Rise in AMS score was not parallel to decrease in SpO_2 but there was some association between these two.

CONCLUSION:

In this study there was a significant decrease in Peripheral oxygen saturation (SpO_2) and increase in AMS Scores. Acute Mountain Sickness was present in all the subjects at the height of Amarnath cave and this was related with decrease in Peripheral oxygen saturation (SpO_2).

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