

Risk factors associated with high altitude sickness: A case control study

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Background and objective

- High elevation adventure is a traveler's choice. However, it has many health repercussions like altitude sickness.
- Altitude sickness presents as AMS, HACE, or HAPE, ranging from mild discomfort to life-threatening emergencies.
- These illnesses represent a significant medical burden to travelers visiting Mustang so it is essential to study and identify specific risk factors.

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- This study aims to identify and analyze the risk factors associated with high altitude sickness among individuals visiting Mustang, providing valuable insights for prevention and management strategies in high-altitude destinations.

Methodology

Study Design and Setting

- A health-facility-based, age-sex matched 1:1 case-control study was conducted in Mustang district, from July 2024 to November 2023.

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- **Cases:** A participant was eligible to be included as a case i.e. Altitude Sickness patient, if he/she, irrespective of place of residence, was a patient aged 18 years or older presenting in emergency services department with AMS/HACE/HAPE** after his/her exposure to high altitude.

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- **Controls:** A participant was eligible to be included as a control i.e. non-Altitude Sickness patient, if he/she, irrespective of place of residence, is patients aged 18 years or older presenting in emergency services department without AMS/HACE/HAPE** after his/her exposure to high altitude or healthy volunteers aged 18 years or older who did not develop AMS during their trip to high altitude.

**A diagnosis was established only if patient met the standard clinical diagnostic criteria.

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- The minimum sample size was estimated to be 63 for cases and 63 for controls at 80% power, 95% confidence level, ratio of case and control as 1:1, expected odds ratio of ≥ 2 , and assumption of exposure by control group.
 - Data was collected face to face using a structured, bilingual (English and Nepali) and pre-tested survey questionnaire prepared from existing related studies.

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- The raw data was entered to Microsoft Excel, where thorough cleaning and consistency checks were performed.
 - All statistical analyses were performed using SPSS version 25.
 - Descriptive statistics were presented as mean and standard deviation or frequency and percentage.
 - Multivariable regression analysis were performed to measure the association between risk factors and altitude Sickness. A p-value of less than 0.05 was considered statistically significant.

Results

- The mean age for cases was 48.46 years (SD=16.57), while controls had a mean age of 48 years (SD=16.94). The overall mean age across both groups was 48.23 years (SD = 16.69). Majority of the participants were female (56%).
- The study group consisted most of individuals of Nepalese nationality (75%). Majority of participants were classified as slow ascenders (65%). A significant majority (65%), reported having no pre-existing health conditions. Most of participants had no history of altitude sickness (79%).

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- Nearly half of the participants (48%) were unaware about altitude sickness. Prophylactic measures (Acetazolamide 125/250mg) were taken by only 36 (29%) of the total 126 individuals.
 - Majority (67%) had Acute Mountain Sickness (AMS) while others presented with High Altitude Pulmonary Edema (HAPE)(20%) and High Altitude Cerebral Edema (HACE)(13%).

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- The results for the comparison of the health variables across cases and controls are shown in Table 1 (next slide).

Variables	Cases (N=63)		Controls (N=63)		p
	n	%	n	%	
Ascent Type					0.000*
Rapid	29	46.03	9	14.29	
Slow	34	53.97	54	85.71	
Comorbidities					1.00
Present	19	30.16	19	30.16	
Absent	44	69.84	44	69.84	
Previous History					0.004*
Yes	19	30.16	6	9.52	
No	44	69.84	57	90.48	
Smoking					0.380
Yes	8	12.70	5	7.94	
No	55	87.30	58	92.06	
Drug History					1.00
Present	13	20.63	13	20.63	
Absent	50	79.37	50	79.37	
Awareness					0.050
Yes	27	42.86	38	60.32	
No	36	57.14	25	39.68	
Intake of prophylactic medicine(Acetazolamide 125/250mg)					0.000*
Yes	9	14.29	27	42.86	
No	54	85.71	36	57.14	

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- The multivariate analysis in Table 2(next slide) revealed significant associations between various factors and the occurrence of altitude sickness.

Variables	Unadjusted		Adjusted	
	OR (95% CI)	p-value	OR (95% CI)	p-value
Ascent Type		0.000*		0.000*
Rapid	5.12(2.16-12.12)		6.41(2.36-17.54)	
Slow	Ref		Ref	
Comorbidities		1.000		0.873
Present	1.00(0.47-2.13)		0.89(0.24-3.45)	
Absent	Ref		Ref	
Previous History		0.004*		0.001*
Yes	4.10(1.51-11.11)		10.20(2.70-38.46)	
No	Ref		Ref	
Smoking		0.380		0.572
Yes	1.69(0.52-5.56)		0.65(0.15-2.86)	
No	Ref		Ref	
Drug History		1.000		0.791
Yes	1.00(0.42-2.38)		0.81(0.18-3.7)	
No	Ref		Ref	
Awareness		0.050		0.460
Yes	Ref		Ref	
No	2.03(1.00-4.12)		1.47(0.53-4.03)	
Intake of prophylactic medicine(Acetazolamide 125/250mg)		0.000*		0.001*
Yes	Ref		Ref	
No	4.55(1.89-11.11)		10.00(2.70-33.33)	

Conclusion

- Our case-control study contributes to the understanding of risk factors for altitude sickness, emphasizing the significance of ascent speed, previous history, and prophylactic measures.
- These findings have practical implications for individuals ascending to high altitudes, providing evidence-based guidance for the prevention of altitude-related illnesses.
- **Key takeaways:** Optimizing ascent speed, accounting for previous history, and implementing appropriate prophylactic measures.

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THANK YOU



- Sishir Poudel, originally from Pokhara, is a medical professional who obtained his MBBS degree from B.P. Koirala Institute of Health Sciences (BPKIHS). He currently serves as a medical officer at Mustang Hospital.