

Highland malaria occurring on Siachen Glacier, Pakistan

Ehtesham Haider,¹ Ismaa Ghazanfar Kiani,² Rizwana Taj,³ Samiullah⁴

Abstract

A case of plasmodium vivax malaria presenting at very high altitude of 16,900 feet (5151 meters) is reported. This is the first case of its kind to be observed from such a high altitude from Pakistan.

Keywords: Plasmodium vivax malaria, Pakistan.

Introduction

Malaria in humans occurs by transmission of Plasmodium sporozoites via a bite from an infected female anopheline mosquito. Transmission typically does not occur at temperatures below 16°C or above 33°C, and at altitude of more than 2,000-2,500 meters.¹ We report herein a case of plasmodium vivax malaria presenting at very high altitude of 16,900 feet (5,151 meters).

Case Report

A previously healthy 25-year-old male was evacuated from a forward post on Siachen Glacier approximately 16,900 feet (5,151 meters) high, with a 4-day history of intermittent fever with rigors and chills. The fever was associated with vomiting, headache and anorexia. The rest of the systemic examination was unremarkable. He had been at that altitude for the past three months. His past history was insignificant for malaria, blood transfusion, or surgical intervention. He was a resident of Siksa (approximately 8,600 feet high) and his travel history below this altitude was non-contributory in the past two years. On examination, he was febrile with a temperature of 101°F, pulse of 125 beats per minute, blood pressure of 100/60 mmHg. There was no pallor, jaundice or lymphadenopathy. His systemic examination did not reveal hepatosplenomegaly. On investigating the patient, his haemoglobin level was found to be 15.8 g/dl, white blood cell count was 8,400 cells/mm³, and the platelet count was 155,000x10⁹/L. Blood films showed rings and gametocytes of plasmodium vivax. The patient was treated with a course of tablet chloroquine and he

made a complete recovery.

Discussion

According to the World Malaria Report 2011, there were 216 million cases of malaria and an estimated 655,000 deaths in 2010. An estimated 500,000 cases of malaria infection occur annually in Pakistan.² Highland malaria, defined as malaria occurring at an altitude higher than 1000 meters above sea level, has been reported from several countries including Argentina (2,180m), Bolivia (2,300m), India (2,500m), Kenya (2,600m), Ethiopia (2,450m), Bolivia (2,600m), Rwanda and Afghanistan.³⁻⁶ This is the first case of highland malaria being reported from Pakistan.

Malaria is one of the vector-borne diseases which is most sensitive to climate. Changes in the climatic factors are important determinants of malaria transmission to humans. A mosquito can only transmit the parasite to a human once it has completed a multifaceted cycle of development inside the mosquito. The length of this cycle depends not only on the parasite species but also on ambient temperature. Consequently, for transmission of the infection from an infected person to an uninfected person, ambient temperatures must be adequately high for a sufficient period of time. When the ambient temperature is too low, mosquitoes cannot acquire infection from an uninfected person, and the parasite cycle inside the mosquito is also affected. Furthermore, mosquitoes cannot transmit the parasite to uninfected persons when the temperature is not ideal. Humidity, air temperature and rainfall not only affect the lifecycle of the mosquitoes but also have an impact on abundance and the rate at which mosquitoes bite humans. Climate therefore has multiple effects on malaria transmission.⁷

Several other factors have been recognised that contribute to the emergence and spread of highland malaria. These factors include changes in environmental and socioeconomic conditions, food production systems, deterioration of healthcare, and the alteration of adaptation of the vectors. Frequent civil unrest and conflicts among armed forces in many countries has forced large populations to settle under extreme weather conditions of the high altitude. This is also a contributing factor for the emergence of highland malaria. Loss of trees

.....
¹Department of Internal Medicine, Combined Military Hospital, Kharian,
²Department of Internal Medicine, Federal Government Polyclinic, Islamabad,
³Health Services Academy Islamabad, ⁴Department of Internal Medicine,
 Military Hospital, Rawalpindi.

Correspondence: Ehtesham Haider. Email: ehtesham2120@hotmail.com

and ground cover at high altitude results in puddles, which provide perfect breeding sites for the mosquitoes. New water development projects, like dams and irrigations schemes, and changes in rainfall pattern have also resulted in new breeding sites for mosquitoes.⁸

Conclusion

This case demonstrates the need of vigilance towards the diagnosis of malaria even at high altitude non-malarious areas to prevent unnecessary delays in management of such patients in a country like Pakistan where malaria is common but overlooked in high altitude areas.

References

1. Bishop RA, Litch JA. Malaria at high altitude. *J Travel Med* 2000; 7: 157-8.
 2. Yasinzai MI, Kakarsulemankhel JK. Prevalence of human malaria infection in bordering areas of East Balochistan, adjoining with Punjab: Loralai and Musakhel. *J Pak Med Assoc* 2009; 59: 132-5.
 3. Lindblade KA, Walker ED, Onapa AW, Katungu J, Wilson ML. Land use change alters malaria transmission parameters by modifying temperature in a highland area of Uganda. *Trop Med Int Health* 2000; 5: 263-74.
 4. Abdur Rab M, Freeman TW, Rahim S, Durrani N, Simon-Taha A, Rowland M. High altitude epidemic malaria in Bamian province, central Afghanistan. *East Mediterr Health J* 2003; 9: 232-9.
 5. Rutar T, Baldomar Salgueiro EJ, Maguire JH. Introduced *Plasmodium vivax* malaria in a Bolivian community at an elevation of 2,300 meters. *Am J Trop Med Hyg* 2004; 70: 15-9.
 6. Loevinsohn ME. Climatic warming and increased malaria incidence in Rwanda. *Lancet* 1994; 343: 714-8.
 7. Berrang-Ford L, Maclean JD, Gyorkos TW, Ford JD, Ogden NH. Climate change and malaria in Canada: a systems approach. *Interdiscip Perspect Infect Dis* 2009; 2009: Article ID 385487. doi:10.1155/2009/385487.
 8. Morse SS. Factors in the emergence of infectious diseases. *Emerg Infect Dis* 1995; 1: 7-15.
-