



## Case Report

## A Tibetan adolescent girl suffered frostbite on the journey of pilgrimage: A case report

Yue Xiao<sup>a, b</sup>, Dan Hao<sup>a, b</sup>, Yue Xin<sup>a, b</sup>, Xian Jiang<sup>a, b, \*</sup><sup>a</sup> Department of Dermatology, West China Hospital, Sichuan University, Chengdu, 610041, China<sup>b</sup> Laboratory of Dermatology, Clinical Institute of Inflammation and Immunology (CIII), Frontiers Science Center for Disease-related Molecular Network, West China Hospital, Sichuan University, Chengdu, 610041, China

## ARTICLE INFO

## Article history:

Received 29 October 2020

Received in revised form

30 August 2021

Accepted 20 September 2021

Available online 30 October 2021

## Keywords:

Frostbite

Amputation

Tibet

Adolescent

## ABSTRACT

Frostbite in Southwestern China has been overlooked due to its low incidence, relatively mild temperature and lack of literature published before. However, it needs to be further studied for religious diversity and distinct geomorphology. In this article, we reported an 18-year-old Tibetan girl who suffered from blizzard attack during pilgrimage. Her feet and several fingers showed mummified gangrene upon physical examination with poor movement. She was diagnosed with 3rd to 4th degree of frostbite. The girl was given oral ibuprofen, debridement and other regular treatment daily, but she was eventually amputated due to insufficient thrombolytic management in primary hospital, delayed informing consent in the referral hospital and ethnic conflict between religion and guidelines. This case enriched the experience of managing complex frostbite in Tibetan population and alarms that efforts should be integrated to protect pilgrims and mountaineers in the Tibetan region.

© 2021 Chinese Medical Association. Production and hosting by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

## Introduction

Frostbite is defined as the tissue damage caused when a human body part was exposed to extremely cold environment. It often involves distal extremities, ears, nose and perineum.<sup>1</sup> With an incidence high up to 36.6% among mountain climbers reported by a cross-sectional questionnaire, frostbite among specific population like mountaineers and people who live in high altitude and latitude areas is rather common.<sup>2</sup> More importantly, severe frostbite is the primary cause of amputation and death in the places with extreme temperatures.<sup>2,3</sup> It can significantly influence patients' quality of life and increase family burdens.<sup>3</sup> In China, frostbite is commonly and well documented in the Northeastern China and inner Mongolia due to its typical geological feature, with over 600 retrospective studies on cold injury have been reported in one decade.<sup>4,5</sup> However, frostbite among the population of Tibet and Western China remains underestimated because of its low

incidence, religious diversity and geological heterogeneity. To the best of authors' knowledge, very little literature concerning the frostbite management on Tibetan population has been reported. Therefore, we present our experience of a Tibetan girl who suffered from blizzard attack on the journey of pilgrimage without appropriate cold-resistant measures, which eventually resulted in amputation.

## Case report

An 18-year-old female Tibetan presented with severe frostbite of fingers and both feet was referred to our hospital on 20th December 2018. Due to the language barrier and insufficient translation devices, her relatives who speak Mandarin translated to us that she was found on the journey of pilgrimage, where religious Tibetans march thousands of miles to the Potala Palace. In the pilgrimage, people kneeled down and kowtowed every 3 steps despite the outer condition. On 15th December 2018, 5 days before coming to our hospital, the girl and 3 companions started their journey. After walking a whole day with little protection, they chose to keep walking when a strong blizzard attacked them. Twelve hours later, they lost sensation in both feet and fingers, followed by pricking and swelling of the lower extremities.

\* Corresponding author. Laboratory of Dermatology, Clinical Institute of Inflammation and Immunology (CIII), Frontiers Science Center for Disease-related Molecular Network, West China Hospital, Sichuan University, Chengdu, 610041, China.

E-mail address: [jennyxianj@163.com](mailto:jennyxianj@163.com) (X. Jiang).

Peer review under responsibility of Chinese Medical Association.



**Fig. 1.** Initial presentation: (A) Feet with mummification and blister in the red square; (B) Left midfinger is swollen and blacken; (C) Midfinger and ring fingertips are blackened.

Nevertheless, they disagreed on whether continuing to go forward or turn back. Unfortunately, 2 of them who chose to go back died because of irreversible hypothermia and disorientation in the blizzard. The patient and another boy continued to march along the road. Eventually, they turned to a local herdsman for shelter where they warmed up their extremities by a fire and then soak limbs in warm water. They were transferred to a local hospital and were treated with infrared radiation therapy and Tibetan medicine, but intra-arterial thrombolytic therapy was not taken because of limited local medical conditions. After 3 days of close watch in the local hospital without improvement, the girl was referred to our hospital for further treatment. In the emergency room, tetanus vaccination was injected and oral ibuprofen (400 mg every 12 h) was given while vital signs were stabilized under regular protocol. The patient felt much better than before because of the proper analgesic therapy. In no more than 6 h, she was then transferred to the burn unit and admitted to the laminar flow ward. Her parents denied any specific medical, family, and psycho-social history.

Upon physical examination, she was in drowsiness and depressed mood. Tips of fingers and feet below the ankle level were black and cold mummified gangrene, presented with blisters with cloudy fluid (Fig. 1). She denied any pain or numbness in her fingertips and feet, and the movement of toes was poor. In palpation, the temperature of her feet was frozen cold which doubting possible freeze-thaw-freeze event; and pulse of both arteria dorsalis pedis can not be felt. Most of the tissue damage demonstrated 3rd to 4th degree of frostbite characterized by mummified appearance and poor movement of toes.<sup>2</sup> There were blisters filling with viscous fluids scattered on her calves, thus the emergent debridement was required. We used an empty needle to extract the blister fluid and left it as a specimen for microbial culture. Then we removed the blisters along their well-defined margins. During her hospitalization, Doppler ultrasound of lower limb veins and basic

laboratory examinations were completed. The ultrasound test showed that there was a partial intramuscular vein thrombosis in the left calf. However, she did not meet the inclusion criteria of thrombolytic therapy due to prolonged prehospital time and freeze-thaw-freeze circle. We attempted to plan amputation surgery with patient and families after evaluating the condition that the demarcation tends to be obvious. Nevertheless, they were outraged because they reverently deem that the human body shouldn't be separated under the overwhelming influence of local Tibetan Buddhism. Based on full respect for their religion and the responsibility for the patient's life, we turned to a Tibetan intern for help who persistently explain and translate the necessity of amputation operation. A few days later, the families eventually agree to receive the surgery (Fig. 2). The patient was transferred to the department of rehabilitation in our hospital to treat phantom limb pain which was common sequelae after amputation.

## Discussion

In Western China, frostbite in Tibetan population remains a serious issue because the treatment for Tibetan patients usually requires good translation of Tibetan, patient communications and sufficient respect to their culture and religion. In our case study, we present a case of a Tibetan adolescent who suffered from frostbite in pilgrimage. In fact, this is only one of the typical Tibetan frostbites in our center.

Inhabit on the Qinghai-Tibet plateau and mountainous area in Western China, Tibetan is a special ethnic minority group in China because most of them believe in Tibetan Buddhism since their childhood and they take the trekking to Lhasa as their life destination. Tibetan pilgrims attribute their fearless to coldness as devoutness to belief. However, this becomes a potential risk for voluntary severe frostbite. Prevention is better than cure among Tibetans. The outdoor time should be limited for the people who probably face the low-temperature environment. When they have to go outside, they have to make sure their clothing is warm enough and their ears and hands be covered.<sup>1</sup> Tibetan health officials and local government should work closely with each other to promote the proper preventive measures.

The treatment of frostbite can be divided into prehospital options and hospital management. The prehospital options include: (1) warming up, (2) removing wet clothing, (3) no alcohol and tobacco using, (4) no rubbing or massage. The hospital management of frostbite includes: (1) imaging, (2) rewarming, (3) blister management, (4) intra-arterial thrombolysis with recombinant tissue plasminogen activator, (5) operation (fasciotomy, amputation).<sup>1,2</sup> However, their attitude of treatment is greatly affected by the doctrine and living Buddha of Tibetan Buddhism, which can result in undesired result as they might differ from the consensus of the international guideline. Despite direct effect of coldness, frostbite initially affect terminal extremities by slowing the filling of the



**Fig. 2.** Eight days after amputation.

capillaries in the skin and muscle tissue, which contributes to the formation of micro thrombosis that eventually lead to necrosis and then amputation.<sup>6,7</sup> The hematocrit increases by 2% per 1 °C decline in core temperature of the human body which enhances blood viscosity.<sup>8</sup> Tibetans are living in high altitude area; therefore, the concentration of red blood cells is significantly higher than that of the Han people, which may be more susceptible to thrombosis. Thus, according to the guideline, the early-stage rewarming and thrombolysis are crucial to the functional recovery of patients.<sup>2,6,8</sup> Doctors from traditional Chinese medicine hospital, traditional Tibetan medicine hospital and western clinical medicine hospitals involved in her treatment at the early stage, but only a part of them are qualified to practice with license. The concept of managing emergent frostbite injuries remains unchanged even outdated for pilgrims and mount climbers who require medical aid. No thrombolysis or sufficient first aid could be applied to the patient on site. The medical resources in this region remains inadequate, critical patients who require transfer or referral still need to travel more than 1900 km to our center. Most patients would have lost the golden hour for initial reversible treatment. When we bring those critically injured patients, mostly what we bring to them can only be “bad news” – a negative message that often destruct the trust between doctors and patients. Additionally, the language barriers cause certain difficulty as most Tibetans do not speak Mandarin. Many words in Mandarin, even not medical terms, do not have a corresponding word in Tibetan, which greatly affect the mutual understanding between doctors and Tibetan patients. In our center, Tibetan translator was equipped to help Tibetan patients, while there was still a large vacancy in other hospitals in southwest area.

The education of frostbite hazard for Tibetans and the attention to Tibetan frostbite patients are deficient, and further efforts ought to be made to provide better early-stage care. Various assistances are needed to guarantee a safe and timely treatment for mount climbers and pilgrims.

### Funding

This work is supported by National Natural Science Foundation of China, No.81872535, and Sichuan Province Pharmaceutical Administration, No.2018HJZX022.

### Ethical statement

Informed consent for publication of photographs was obtained from the patient.

### Declaration of competing interest

The authors declare that there is no conflict of interest.

### Acknowledgements

We thank the patient and her family members for participating in this study.

### Author contributions

Yue Xiao drafted the manuscript. Dan Hao and Yue Xin collected patient's information and participated in manuscript editing. Xian Jiang did the manuscript editing.

### References

1. Torpy JM, Lynn C, Golub RM. JAMA patient page. Frostbite. *Jama*. 2011;306:2633. <https://doi.org/10.1001/jama.2011.1799>.
2. Handford C, Thomas O, Imray CHE. Frostbite. *Emerg Med Clin North Am*. 2017;35:281–299. <https://doi.org/10.1016/j.emc.2016.12.006>.
3. Kraft C, Millet JD, Agarwal S, et al. SPECT/CT in the evaluation of frostbite. *J Burn Care Res*. 2017;38:e227–e234. <https://doi.org/10.1097/bcr.0000000000000359>.
4. Li Q, Wang LF, Chen Q, et al. Amputations in the burn unit: a retrospective analysis of 82 patients across 12 years. *Burns*. 2017;43:1449–1454. <https://doi.org/10.1016/j.burns.2017.04.005>.
5. Su H, Li Z, Li Y, et al. Treatment of 568 patients with frostbite in northeastern China with an analysis of rate of amputation. *Zhonghua Shaoshang Zazhi*. 2015;31:410–415. <https://doi.org/10.3760/cma.j.issn.1009-2587.2015.06.004>.
6. Gonzaga T, Jenabzadeh K, Anderson CP, et al. Use of intra-arterial thrombolytic therapy for acute treatment of frostbite in 62 patients with review of thrombolytic therapy in frostbite. *J Burn Care Res*. 2016;37:e323–334. <https://doi.org/10.1097/bcr.0000000000000245>.
7. Rivlin M, King M, Kruse R, et al. *J Athl Train*. 2014;49:97–101. <https://doi.org/10.4085/1062-6050-48.6.19>.
8. Petrone P, Asensio JA, Marini CP. Management of accidental hypothermia and cold injury. *Curr Probl Surg*. 2014;51:417–431. <https://doi.org/10.1067/j.cpsurg.2014.07.004>.