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Original Article

Pattern of chilblains in a high altitude region of Ladakh, India



Lt Col G.K. Singh^{a,*}, Brig A. Datta, SM^b, Brig R.S. Grewal, vsm^c,
Col M.S. Suresh^d, Brig S.S. Vaishampayan^e

^a Graded Specialist (Dermatology & Ven), Command Hospital (Eastern Command), Kolkata 700027, India

^b Commandant, MH Jalandhar, India

^c Prof & Head (Dermatology), Army College of Medical Sciences, Delhi, India

^d Senior Advisor (Dermatology, Ven, Lep), Command Hospital (Eastern Command), Bengaluru, India

^e Commandant, MH Nasirabad, India

ARTICLE INFO

Article history:

Received 7 October 2012

Accepted 1 January 2013

Available online 10 May 2013

Keywords:

Chilblains

Perniosis

Ladakh

High altitude

ABSTRACT

Background: Extreme sub-zero temperature in winters (15 °C to –25 °C), high velocity winds and wind-chill factor pose risk to those who resides at the high altitude environment to develop cold related injuries like chilblains and frostbite. The aim of this study was to study the patterns of chilblains in high altitude region like Ladakh.

Methods: The study was conducted at Dermatology outpatient department of Military Hospital, Leh from 1 Sep 2009 to 31 May 2010. Patients, satisfying clinical criteria for the diagnosis of chilblains were included into the study. Detailed history and thorough clinical examination was conducted. Complete blood count and Urine routine examination was carried out in every patient. Anti Nuclear Factor tests were carried out in only those who had history suggestive of connective tissue disease.

Results: Total 108 (5.75%) were diagnosed to have chilblains. Only a single case of chilblain was found in a local resident ($p < 0.005$). Family history of chilblains was present in 10 (9.2%) patients, there was recurrence in 12 (11.1%) and 21 patients (19.4%) were smokers. Most (63.8%) of the patients, had BMI between 20 and 22 kg/m² (mean = 20.03 kg/m²; 95% CI = 19.68–20.38 and SD 1.82). 42.1% of cases of chilblains also had hyperhidrosis ($p < 0.05$).
Conclusion: In a HA area like Ladakh, the non-natives suffer maximum from chilblains. This could be explained by the protective genetic adaptability of natives to extreme cold environment and their protective life style against cold. Low body mass index (BMI) and hyperhidrosis are important associations for development of chilblains.

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Introduction

Ladakh—"Land of high mountain passes"—is situated in the northwestern part of India, on the slopes of the Great

Himalayas. Leh, the Divisional headquarter of Ladakh, is situated at an altitude of 3650 m (12,000 feet) and is classified as a high altitude area. Extreme sub-zero temperature in winters (17 °C to –30 °C), high velocity winds and a high wind-chill

* Corresponding author. Tel.: +91 8697717018.

E-mail address: gk_1jun@yahoo.com (G.K. Singh).

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<http://dx.doi.org/10.1016/j.mjafi.2013.01.011>

factor poses risk to humans who reside at this high altitude environment to develop cold related injuries like chilblains and frostbite.¹ Chilblains or perniosis are localized inflammatory lesions caused by continued exposure to cold above the freezing point. Clinically, it is characterized by erythematous, oedematous macules, papules and plaques. Vesicles and ulceration may occur in severe cases. Chilblains often affect distal extremities but ears, nose, face, and thighs may also be involved. Pathophysiology of chilblains is largely unknown; however, it represents an abnormal vascular response to cold.²

Risk factors include inadequate clothing, inadequately warm living conditions, dehydration, fatigue and previous cold weather injuries.³ Chilblains may be idiopathic or secondary to an underlying disease, like, chronic myelocytic leukaemia, cold agglutinins, cryoglobulinemia, cryofibrinogenemia, macroglobulinemia, dysproteinemia, anorexia nervosa and systemic lupus erythematosus.^{4–7} The apparent cause of chilblains in all cases is exposure to cold. Although, chilblains is benign, self limiting condition, in certain cases, laboratory investigations like complete blood count, erythrocyte sedimentation rate, autoimmune profile, cryoglobulins, cryofibrinogens, cold agglutinins and serum protein electrophoresis may be carried out to rule out any associated systemic conditions.⁸ Treatment is usually symptomatic with avoidance of further exposure to cold. Many treatment modalities have been tried with variable results. These include re-warming of the affected parts of the body, ultraviolet rays,⁹ vasodilator calcium channel blockers like nifedipine^{10,11} topical minoxidil,² prazosin,¹² topical anti-pruritics and iontophoresis¹³ etc. Military hospital at Leh has the unique distinction of being the only Dermatology centre in entire Ladakh region, looking after the soldiers deployed there as well as the native civilian population. So far, no large scale studies have been carried out in this region regarding the prevalence and pattern of chilblains. The aim of this study was to determine the frequency and patterns of chilblains amongst patients who were reporting to Dermatology outpatient department of Military Hospital, Leh.

Material and methods

This was an observational study, carried out at Military Hospital, Leh from 1 Sep 2009 to 31 May 2010. Diagnosis of chilblains was based on history of itching, numbness, pain of affected body parts and clinical examination. All the patients reporting with erythematous macules, papules or plaques or oedema associated with or without vesicles and ulceration involving digits or other peripheral parts of the body, along with the history of either itching, pain or numbness of involved areas, during above mentioned period were included into the study. All types of frostbite cases were excluded from the study. Detailed history, dermatological as well as systemic examination was carried out. History was recorded in a pre-designed proforma which included details of age, sex, occupation, permanent residence (Local Ladakhi/North Indian/South Indian/Nepali), time since arrival in the high altitude area, duration of present episode of chilblains, family history of chilblains, Raynaud's phenomenon, history suggestive of

connective tissue disease like oral ulcers, joint pain photosensitivity etc. and whether smoker or non-smoker. Patients who had arrived for the first time in the high altitude area were labelled as 'fresh inductees'. History for any associated dermatological or systemic illness in the past or present was also obtained. In addition, dermatological as well as systemic examinations were carried out in detail to find out any associated disease. Complete blood count and Urine routine examination was carried out in every patient. Anti Nuclear Factor tests were carried out in only those patients who had history suggestive of connective tissue disease. Those patients requiring admission, the average stay of hospitalization was recorded. All patients were followed up for one month for any recurrence. Statistical package Epi Info 2002[®] was used to conduct the statistical analysis. Results were deemed significant if the *p* value was <0.05.

Results

A total of 1876 patients were registered in Dermatology outpatient department of Military Hospital, Leh during the period from 1 Sep 2009 to 31 May 2010. Of these, 883 (47%) were serving soldiers, 787 (41.9%) were local Ladakhi and 206 (10.9%) were non local civilian. Out of these 1876 patients, 108 (5.75%) were diagnosed to have chilblains. Eighty three (76.8%) of these patients had developed the disease during the months of Dec, Jan and Feb. Of the 108 chilblains patients, 97 (89.8%) were males and 11 (10.1%) were females. The age at presentation ranged from 12 to 46 years with a mean of 29.73 years (95% CI of mean 28.24–31.22 and SD 7.8). Age at onset in majority of the patients (53.7%) was between 21 and 30 years. Demographic profile of the patients is depicted in Table 1. Twenty one (19.4%)

Table 1 – Demographic profile of cases of chilblains, (n = 108).

Parameters	Number (%)
Age at onset (in years)	
1–10	Nil
11–20	3 (2.77%)
21–30	58 (53.7%)
31–40	35 (32.4%)
41–50	12 (11.11%)
>50	Nil
Gender	
Males	97 (89.81%)
Females	11 (10.18%)
Occupation	
Outdoor workers	96 (88.88%)
Soldiers	73 (67.59%)
Labourers	18 (16.66%)
Traders	5 (4.6%)
Indoor workers	12 (11.11%)
House-wives	7 (6.48%)
Office workers	5 (4.62%)
Residence	
North Indian	67 (62.03%)
South Indian	35 (32.4%)
Nepali	5 (4.62%)
Locals	1 (0.92%)

Table 2 – Summary of history of cases of chilblains.

	Number (%)
Past h/o chilblains	
Yes	12 (11.11%)
No	96 (88.88%)
Family history of chilblains	
Yes	10 (9.25%)
No	98 (90.74%)
Smoking	
Yes	21 (19.44%)
No	87 (80.55%)
Fresh inductee	
Yes	28 (25.92%)
No	80 (74.07%)
Raynaud's phenomenon present	
Yes	2 (1.85%)
No	106 (98.14%)
Past h/o	
Medical ^a	3 (2.77%)
Surgical ^b	1 (0.92%)
Onset in days	
1–7	35 (32.40%)
8–14	64 (59.25%)
15–21	8 (7.40%)
>21	1 (0.92%)
Chief complaints	
Pain	12 (11.11%)
Itching	18 (16.66%)
Both	68 (62.96%)

^a Primary hypertension – 2, pulmonary tuberculosis – 1.

^b Appendicitis operated – 1.

patients were smokers, while past history of chilblains was present in 12 (11.1%) and family history of chilblains was present in 10 (9.25%) patients ($p > 0.05$). Details of history are described in Table 2. Sixty nine (63.8%) of the patients, had BMI ranging between 20 and 22 kg/m² with arithmetic mean of 20.03 kg/m² (95% CI for mean 19.68–20.38 and SD 1.82). This result was found to be statistically significant i.e. $p < 0.05$. So, the chances of having chilblains in persons with low BMI are much high. Twenty three patients (21.3%) had associated dermatological conditions, of which hyperhidrosis was commonest and present in 9 (8.3%) patients. A total of 21 patients were diagnosed to be suffering from hyperhidrosis during the study period and out of these 9 also had chilblains as mentioned above. Thus, 42.1% of cases of hyperhidrosis had developed chilblains with p value < 0.05 signifying the fact that people with hyperhidrosis were more prone to develop chilblains. In our study, the average number of days to become asymptomatic from chilblains was 14.5. Total 9 (8.3%) cases required admission. Out of 9 cases, one was considered unfit for the high altitude area because of the disease severity and history of recurrence. Three had associated systemic diseases which were not found to be statistically significant. Summary of examination findings are depicted in Table 3.

Discussion

Ambient temperature of the Ladakh region during winters varies between maximum 15 °C and minimum –25 °C.

Table 3 – Summary of examination findings of cases of chilblains.

Parameters	Number (%)
BMI (kg/m²)	
<17	Nil
17–19	36 (33.33%)
20–22	69 (63.88%)
23–25	3 (2.77%)
>25	Nil
Dermatological examination	
Erythema and oedema	58 (53.70%)
Erythema, oedema and pigmentation	38 (35.18%)
Erythema, oedema with vesicles	5 (4.62%)
Erythema, oedema with ulcers	7 (6.48%)
Involvement	
Hand	23 (21.29%)
Feet	45 (41.66%)
Both	32 (29.62%)
Dermatological diseases	
Yes ^a	23 (21.29%)
No	85 (78.70%)
Systemic diseases	
Yes ^b	3 (2.77%)
No	105 (97.22%)

^a Hyperhidrosis – 9, tinea pedis – 2, acne vulgaris – 3, polymorphic light eruption – 3, melasma – 4, alopecia aerata – 2, psoriasis – 1.

^b Hypertension – 2, diabetes mellitus – 1.

However, development of chilblains can occur even at above freezing temperatures. The exact incidence of the disease in India is not known and the frequency of chilblains varies with weather conditions. In England, the annual incidence is said to be upto 10%¹⁴ and in France it is 2–6%.¹⁵ However, in our study frequency of chilblains between months of Sep and May was 5.7% which is very high. There was only a single case of chilblain in the native population which, on detailed evaluation was found to be a case of systemic lupus erythematosus. The almost, negligible rate of chilblains in the native population (1 out of 787 OPD cases) is statistically very significant ($p < 0.005$). Although, large population based case control studies are required to confirm that native Ladakhi has less propensity to develop chilblains, nevertheless, it can be explained by their genetic make-up and ingrained protective life style against extreme of cold.

The comparative frequency of chilblains in North Indian, Nepali and South Indian populations could not be commented upon because of frequent change of denominators in those groups. The hospital admission rate of soldiers of Indian army due to chilblains is 0.08 per thousand troops.¹⁶ In our study hospital admission was required in 9 cases (8.3%) of chilblains. This cannot be compared with above data due to variability of the denominator.

Chilblains can occur at any age and are said to be more common in females.^{8,15} But in our study males were seen more often than females since composition of the study population had predominance of males, with very few families. Out of 97 male patients, 73 (75.2%) were serving soldiers and only 24 (24.7%) males were from all other categories. Chilblains have been found to be uncommon in children in a few studies,¹⁴ but others found that the disease is common in children.⁵ In our study, only three were children, i.e. upto 14

years of age. Leh, being a non-family station for soldiers and almost negligible case of chilblains in the native Ladakhi woman, this finding cannot be stressed upon.

Maximum number of patients belonged to the age group of 21–30 years. This can be explained by the large number of young soldiers as well as labourers working in this area. The disease was more common in outdoor workers with the apparent reason of being more exposed to cold. Study by Raza N et al has also reported similar observation.¹⁷

Smoking poses a definite risk to develop cold related injuries.³ A large number i.e. 21 (19.4%), subjects were smokers. However, the correlation of smoking with chilblains was not found to be statistically significant with p value $> 0.05\%$. Probably this could be explained by the lack of large population size and control. Low BMI is a known risk factor for development of chilblains.²

One third of patients 36 (33.33%) had BMI ranging from 17 to 19. The study done by Prakash S, Weisman MH found that BMI less than 19 kg/m² is a risk factor for development of chilblains.¹⁸ In the study of chilblains on adolescent by Simon TD et al revealed that all the cases of chilblains had BMI less than 25th percentile or 18 kg/m².¹⁹ A chilblain in cases of anorexia nervosa also explains the same.⁶

38 (35.18%) patients had pigmentation along with erythema and oedema. This can be explained by the texture of the Asian skin where purpuric macules are visible as hyperpigmented macules. In our study 5 (4.6%) had vesicles and 7 (6.4%) had ulcers along with erythema and oedema. The commonest site of involvement in our study was feet alone in 45 (41.6%), followed by both hands and feet in 32 (29.6%), while hands alone were involved in 23 (21.2%) patients (Figs. 1 and 2). In a study by Chan Y et al similar findings were noted where 45% patients had digital swelling, and painful erosion or ulceration were observed in 18%.²⁰ There were no cases of chilblain in other susceptible areas like ears, nose and thighs. This can be explained by the relatively poor blood supply in the feet. Prolonged standing and exposure to cold in the outdoor workers adds to the misery.

In an early study in year 1967 by Stewart WM found hyperhidrosis as a risk factor for development of chilblains.²¹ There are no other studies which have studied hyperhidrosis as a risk factor for chilblains. Our study, also revealed high



Fig. 1 – A case of chilblains of both feet.



Fig. 2 – A case of chilblains of both hands. Black pigmentation on the nails of three fingers of left hand is due to application of nail polish.

number of hyperhidrosis patients ($n = 9$, 42.1%) developing chilblains ($p < 0.05$) thereby signifying that hyperhidrosis might be a risk factor for the development of develop chilblains.

Viguier et al⁷ in a study stressed that chronic course of chilblains may underlie connective tissue disease and the female sex, persistence of lesions beyond cold seasons were significantly more associated with chilblain lupus erythematosus. In our study, only a single native Ladakhi woman developed chilblains. During detailed evaluation, she was found to have ANA, Ds DNA positivity along with other features of systemic lupus erythematosus. Anti Nuclear Factor was positive in only 2 cases. Of these, one was a Ladakhi woman and the other was a serving soldier. One soldier with chilblains who was ANA positive also had associated polymorphic light eruption on the neck and forearm; however during long follow up he did not show features of systemic lupus erythematosus or subacute cutaneous lupus erythematosus. In a case control study by Morioka N et al revealed that chilblain which SLE patients developed had some characteristic features compared to that of control, like higher incidence of chilblain episodes, longer disease duration until cure, more chances of erosion or ulceration and frequent occurrence of chilblain in the seasons other than winter.²² Our only case also had similar features.

Chilblains is a benign condition which resolves within a few weeks without any residual effects. However, one needs to be cautious in chronic, recurrent and woman patients.² All 9 patients that required hospital admission in our study had past history of chilblains. This signifies that recurrent chilblains might have a severe course. However, there was no association with woman history of chilblains, Raynaud's phenomenon and ANA positivity.

Chilblains, like other cold weather injuries are a preventable disease.³ Wearing of warm clothing's in layers, once or twice daily soaking of hands and feet in warm water followed by drying and application of emollients; wearing double layer good quality nylon and woolen socks, comfortable shoes or good quality wind and cold protective gloves, plenty of oral

fluids including tea and coffee, nutritious diets, supplement of vitamin C, encouraging the persons to report sick; are well established preventive measures in extreme cold climate areas for prevention against cold injuries.²³ Every medical officer posted to high altitude area should be well versed with this condition. Timely diagnosis, supportive management, referral to higher centre for recurrent cases can reduce the morbidity of troops as well as other lowlanders in this region.

Conclusion

In a HA area like Ladakh, it is the lowlanders who suffer maximum from chilblains. Many people develop chilblains for the first time in their life which might be due to poor acclimatization from cold and inadequate protection to cold. Almost negligible chilblains in local Ladakhi could be explained by their genetic adaptability to extreme cold environment and their protective life style against cold. Low BMI and hyperhidrosis are important risk factors for development of chilblains. Any patient of chilblains, who has got associated history of connective tissue disease, should be thoroughly investigated for systemic involvement. Recurrence of chilblains is quite common and troublesome; however, if adequate precautions against cold are taken, morbidity due to chilblains could be avoided even at these extreme cold climatic conditions. Further, large population based and case control studies are required to determine the exact epidemiological determinants of chilblains in high altitude.

Conflicts of interest

All authors have none to declare.

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