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Frostbite – From Turkish Eastern Border As A Consequence Of Irregular Migration

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ABSTRACT

Frostbite is becoming more prevalent within the homeless, mentally ill and substance abusing subgroup. However; our objective is to evaluate the clinical presentation, treatment and consequences of frostbite seen in a different population– irregular migrants captured at Eastern Border of Turkey. In addition, up to date approach to frostbite injury is reviewed.

Data extraction was done retrospectively from 40 patients' admission to hospital from 26 January till 25 February 2020. Each patient was assigned with the grade of the most severe frostbite lesion detected at the admission. Clinical pictures were captured for the follow up of demarcation at each dressing change. Multidisciplinary treatment modality was summarized.

38 patients were included. Within the population dominated mainly by male young adults, 74% of the patients presented with Grade 3-4 severity whereas 26% were assigned with Grade 1-2 frostbites. Majority of the frostbitten areas were confined to lower extremities. Assigned frostbite gradings at the admission didn't deflect within the hospitalization period apart from 3 patients worsening towards grade 4 following fasciotomy.

Frostbite injury has detrimental outcomes if not recognized and treated in a timely manner. If not, the likelihood of receiving amputations significantly increase.

Keywords: Illegal migrant, frostbite, amputation, high altitude

Introduction

Whoever spins the globe map nowadays, one could easily pinpoint The Republic of Turkey located on the Anatolian peninsula which is roughly presumed to sustain a mild climate compared to neighboring countries. In contrary, the eastern border faces harsh winter conditions due to high altitudes. The temperatures did drop down to -30 °C in January 2020 leaving the locals with the highest snowfall for the last 60 years and several avalanches taking many lives. The emergency team and the surgeons of our institution treated the frostbite injuries of those but one specific group consisting of illegal immigrants struck by that extreme cold. In the 21st century, the immigration crisis is a mainstream humanitarian disaster forcing Middle-Eastern folks from different ethnic backgrounds towards the west through several dangerous routes, one of them trespassing the Turkish eastern border. The sociopolitical issue of illegal immigration is beyond the scope of this paper but one should purposefully discuss its' reflection on the day-to-day practice of the medics. Frostbite is the medical condition in which local or generalized damage starts at the level the skin affecting deeper tissues with prolonged exposure and due to inadequate protection from ambient subfreezing temperatures (1). In contrast to thermal burns, cold injuries are rare (2,3). Majority of cold injuries are reported from northern territories such as Alaska, Arctic Greenland where mean temperature is quite low. Historically, frostbite had been frequently reported among military personnel (4,5). However, in the recent years, the higher incidence has shifted towards civilians those are drug addict, homelessness, mental illness, disabled and those with vascular disease (6). Although it bares "burn" within its' title, the cold burn needs a different approach. There is an applied treatment modality for thermal injuries but there is not such an internationally accepted model for cold burns (7,8). Therefore,

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pathophysiology of frostbite needs to be explored and investigated much more. In this study, frostbitten irregular migrants who try to cross the east border of Turkey were analyzed.

Materials and Methods

Starting from 26 January until 25 February 2020; one after another; a total of 40 patients were admitted to our emergency department and burn unit with the complaint of freezing. Initially, all patients were enrolled to the study. However, two of them escaped from the premises on the 3rd day of their admission. Therefore, the final data collection had to be completed on the remaining 38 patients.

Informed surgical and photography consents were taken from all patients via Pakistani or English interpreters. Ethical approval was taken from institutional ethical board (number: 5/11/2020, 22/2020). All procedures were carried out with taking into account the Helsinki Declaration standarts.

The demographics were documented from each subject. The characteristics of injury were graded at the admission according to the classification scheme offered by Handford et al. (Table-1). The patients were examined and treated by a multidisciplinary team which included the burns care physician and the nurse, plastic surgeon and a hand surgeon. Daily clinical pictures were during dressing sessions for the follow up of necrotic demarcation.

Statistical Analysis: All data was recorded on Excel (Microsoft Corp. Office program 2010). Since no analytical analysis was performed, all results were extracted from the excel program. Categorical and nominal variables were given as frequencies (%). Continuous variables – since normally distributed – were given as mean and standard deviation.

Medical Approach

At the Emergency Department: Twenty-six Pakistani, Persian, Bangladesh, Syrian and African immigrants who were captured at the eastern border by the military officers, were brought into the emergency room (ER) right away. Apart from these; 12 patients attended to emergency department by themselves. Through history taking, none was able to recall the total length of the cold exposure. Obviously, there weren't any adequate protective clothing worn. On the primary survey, 36 patients were noted to be systemically normothermic with stable vital signs while 2 others arrived at the ER with mild hypothermia (34.3 to 34.8 °C). The history of tetanus immunization was obtained with the help of interpreters and prophylactic antibiotics and analgesics were initiated. After getting initial hand x-rays to exclude underlying osseous injury, rapid rewarming was initiated immediately with warm intravenous (IV) crystalloid infusions and passive blanket application. Hands and feet were immersed in 38-400 hot water for about 20 minutes (Figure-1). In case of compartment syndrome, the plastic surgeon performed bedside debridement and fasciotomy (Figure-2). Once the patients were stabilized, they were transferred to the burn unit for further medical management. At the Burn Unit Plastic surgeon, hand surgeon, physiotherapist, psychologist and orthopedic surgeon were included in the multi-disciplinary team. Having completed the blood work on the first day, all patients were monitored and rehydrated with Ringer's lactate solution. High calorie intake was initiated following starvation for several days keeping in mind the risks of refeeding syndrome. Calcium channel blocker Nifedipine (30 mg od), vasodilator Pentoxifylline (100 6 mg od) and Ibuprofen (200 mg tid) were administered during the acute treatment period. Anticoagulation was given with a daily dose of 40 mg Low-molecular-weight heparin (LMWH). Immersion in circulating warm water was followed by gentle drying, elevation, deroofing of clear blisters, aspiration of hemorrhagic blisters followed by loose antibacterial dressings and splinting in a position of function. Hyperbaric oxygen therapy was initiated for those who started to show signs of distal ischemia within the first 48 hours. Eligible patients were commenced on physical therapy from the first day until discharge. Before final surgery we wait several days to see demarcation line and then decide to surgery type. Unfortunately, the long-term follow up could not be carried out as the patients had to be deported once the patients were stabilized.

Results

In about 29 consecutive days, 40 irregular migrants were admitted to our hospital. Thirty-eight patients' demographical data, hospitalization period and basic inflammatory marker levels were given in Table-2. Majority of victims were young males (74%). From the female subgroup (26%), 2 ladies were captured with 3 toddlers; all presenting with a minimum of Grade 2 injury. Seventy-one percent of patients (n=27) had severe edema and

Table 1. Classification Scheme for The Severity of Frostbite Injuries of Extremities

Frostbite injury	Grade 1	Grade 2	Grade 3	Grade 4
Extent of initial lesion on day 0 after rapid rewarming	Absence of initial lesion	Initial lesion on distal phalanx	Initial lesion on intermediary (and) proximal phalanx	Initial lesion on carpal/ tarsal
Bone scanning on day 2	Useless	Hypofixation of radiotracer uptake area	Absence of radiotracer uptake on the digit	Absence of radiotracer uptake on carpal/tarsal region
Blisters on day 2	Absence of blisters	Clear blisters	Hemorrhagic blisters on the digit	Hemorrhagic blisters over carpal/tarsal region
Prognosis on day 2	No amputation	Tissue amputation	Bone amputation of the digit	Bone amputation of limb +/- systemic involvement+/- sepsis
	No sequelae	Fingernail sequelae	Functional sequelae	Functional sequelae

*Handford, C., Buxton, P., Russell, K. et al. Frostbite: a practical approach to hospital management. ExtremPhysiol Med 3, 7 (2014)

Table 2. Patients With Frostbite: Patient Demographics

	Female (n=6, %26)	Male (n=32, %74)
Age (mean±SD)	18,8 (±10,7)	23,6(±10,8)
LOS (days) (mean± SD)	15,7±6,7	
CRP (mg/lt)	32±9,8	
WBC (1000/µl)	5000±940	

SD: Standard deviation, LOS: Length of stay, CRP: C-reactive protein, WBC: White blood cell

hemorrhagic blisters either on feet (n=17) or hands (n=10). Four migrants had Grade 4; 7 migrants had grade 1-2 frostbites involving both hands and feet on admission. Ten patients were reported to have loss of tactile sensation to all of their fingertips bilaterally and 3 of them demonstrated painful active and passive flexion - extension of the digits with a rising sense of palmar pressure as well, hardened hand compartments consistent with compartment syndrome necessitating fasciotomies. From the first day till the end of treatment, clinical pictures are summarized in Figure-3. As seen from images, frostbite is a dynamic 7 process just like thermal injury. As the patients were followed up, only 3 patients who were the receivers of hand compartment release progressed into grade 4 severity. Despite the patients with grade 3-4 injuries (73,6%) needed finger amputations and further debridement, all but one turned down the procedure and insisted on being deported back home. Just one patient who had 5th fingertip necrosis accepted amputation. Rest of the 6 amputations performed were all on toes. Two runaway patients had grade 1-2 frostbite on their fingers and fortunately demonstrated adequate distal circulation at the end of their 3rd and the final day of hospitalization. The main disadvantage during salvage was communication barrier since most patients couldn't speak or understand a word of Turkish. The nursing staff couldn't understand their claims either and the interpreters visited the hospital once in a week due to formal policies.

Discussion

Turkey is on one of the key transit routes for smuggling of migrants from Asia, Africa and Middle East into Europe (9). A significant portion of irregular migrants trespasses Turkey particularly from the eastern borders. Despite the harsh winter climate in 2020, the locals weren't reported to

Fig.1. Hot water bathes-closely monitored (38°C-40°C) to thaw cold injuries

Fig.2. Fasciotomy and bedside debridement of hands

suffer from cold injury apart from the avalanche disaster. However, majority of the cases struck by the extreme cold were the irregular migrants arrested on the mountains. Thereafter, Turkish medical team voluntarily participated in the treatment of the injuries. Our study result presents information on the demographics and the severity of injury of those frostbitten irregular migrants treated at a regional hospital with fairly limited resources in the eastern border of Turkey. As a concept, frostbite develops within minutes to hours depending on circumstances and risk factors. Our patients were exposed to almost all of the risks such as subfreezing ambient cold, (8) windchill, inadequate insulation, exhaustion, dehydration and malnutrition. As of experience, majority of them already develops high grade frostbite injuries. Therefore, management of frostbite should begin in the safe prehospital setting whilst the patient is being transferred making sure there is no risk of ambient

Fig.3. Gradual demarcation of digital gangrenes within follow-up

temperatures that may cause re-freeze[10]. Undressing of the patient should be performed with extreme caution in order not to cause further damage. All jewelry should also be removed. Upon arrival to the emergency department, the patient needs to be assessed as per Advanced Trauma Life Support (ATLS) as previously mentioned in the medical approach section. Underlying conditions and comorbidities should be sought. Once medically stable, the team could start the invasive procedures on the patient such as gradual rewarming of the extremities passively with blankets or actively with 15 minutes to 1-hour warm water lavage/bathing sessions at 37-39 °C until the tissues get better perfused and more pliable (11-14). In cases where compartment syndrome is taught, rapid decompressive fasciotomy is indicated. The clear blisters should be deroofed and debrided under sterile conditions and the patient may require sedation or general anesthesia for these procedures. If hemorrhagic blisters occur, one could assume that the injury reaches deeper to the reticular dermis. Tissue protection from further insult should be of utmost importance whilst performing daily dressing change. Limb elevation, loose, non-adherent or negative pressure dressings and splinting have paramount importance until the necrotic demarcation period comes to an end. As seen in our group of patients, the natural course of severe frostbite injury takes several weeks to months until viable and nonviable tissues demarcate. For this reason, premature amputations should be avoided in order not to remove soon- to -be viable and functional tissue and cause further morbidity (9). Apart from surgical management,

these patients require intricate medical protocols such as proper analgesia, antibiotics, antiaggregant, thrombolytic and vasodilatory treatments such as acetylsalicylic acid, heparin, Tissue Plasminogen Activator (t-PA) and iloprost infusion (15,16). In our series, calcium channel blockers and vasodilators were preferred due to limited medical supplies and high economical costs of the first line drugs used in cold injury. If thrombolytic therapy can be initiated, certain imaging studies such as plain or digital subtraction angiography, magnetic resonance imaging (MRI) angiography, bone scans should be carried out to assess viability and perfusion of tissues prior to the treatment and for the evaluation of outcome (17). Following the acute management, patients may experience chronic recurrent ulcerations, arthritis, cold intolerance and chronic pain syndrome. Therefore, they may require sympathectomy and/or hyperbaric oxygen therapy if basic management strategies result in limited vasodilatation and oxygenation of the affected tissues (18-20).

Limitations: Unfortunately, the long-term follow-up and functional outcome reports couldn't be carried out in this study as the patients had to be deported.

The presented case series demonstrate a wide range of frostbite injury seen in irregular migrants who happened to experience long periods of subfreezing temperatures with multiple thawing-refreezing cycles. New therapeutic protocols are promising but salvage of the tissues purely depends on the punctuality of the first responders such as military officers and ambulance team in remote areas. As per our institutional experience, such groups should be made aware of this type of injury as early prehospital management and prompt diagnosis leads to proper treatment and better clinical outcomes.

Box-ED

What is already known on the study topic?

Prolonged exposure to cold result in tissue damage that is known as "frosbite". Frostbite injuries common in military personnel, homeless population, substance abused persons.

What is the conflict on the issue? Has it importance for readers?

Illegal immigration crisis effect doctors (especially emergency doctors) practice day-to-day. Irregular Immigrants travel through very dangerous routes that include subfreezing temperatures. There is a gap in treatment and emergency management of this specific group.

How is this study structured?

This was a single-center, prospective observation study includes data from 38 patients.

What does this study tell us?

Because immigrants do not know the language of local place and the roads to hospitals, treatment start very late. New therapeutic protocols are promising but salvage of the tissues purely depends on the punctuality of the first responders such as military officers and ambulance team in remote areas.

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