FROSTBITE DURING KASHMIR CONFLICT

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ABSTRACT

The aim of this study was to evaluate different modalities of management of cold injuries including gradual re-warming, administration of vasodilators, and surgical intervention.

A total number of 2564 cases of frostbite were treated during December 1988 to March 2003, mostly at local hospitals of Muzaffarabad, Azad Kashmir. The frost bitten cases were refugees who suffered frostbite during their movement across the line of control alongside the Himalayan mountains over 12000 feet altitude above sea level. Management of these patients involved multidimensional approach with prudent strategy "if frost bitten in January amputate in June." The patients were categorized into four groups depending upon the severity of injury. All the patients were gradually rewarmed. The severally injured (100%) and moderately injured patients (50%) were administered 5 mg nifidepine, 5 ml 1% lignocain in femoral vessel, alongwith administration of systemic antibiotics accompanied by limited wound debridement and wound dressing. Patients were watched till clear demarcation line appeared between the live and dead tissue. Sequelae of cold injuries and the rate of complications reduced by adopting this management policy.

Keywords: Frost bite, gradual rewarming, amputation, limb salvage, painful limb, raynaud's phenomenon

INTRODUCTION

Cold injury is not a common form of trauma these days because of the remarkable development in industrial and social sectors. In the developed world, severe form of cold injuries has become a rare occurrence. Mild to moderate form of frostbite is still encountered in developed countries where atmospheric temperature falls below zero Celsius and victims are commonly sportsmen or soldiers.

Frostbite has been classified into mild, moderate, severe and complex forms, depending upon the amount of tissue damage caused by cold injuries [1,2,3]. In mild frostbite, injury is superficial which in characterised by pallor, transitory cyanosis, erythema on re-warming and numbness. The complete healing occurs within few weeks. In moderate frostbite there is involvement of full thickness of skin with necrosis and loss of skin. It is clinically characterized by complete anaesthesia, haemorrhagic blisters and swelling. If not managed properly it may extend to the deeper tissue or structures. The severe frostbite is characterised by the loss of limb or it's part including loss of one or more toes or fingers or a part of a finger due to gangrene. The complex frostbite is the most severe form of cold injury with systematic involvement like renal, respiratory, cardiovascular and other systemic involvement and injuries other than frostbite.

During World War-II, Russian surgeons reported over 2000 cases of severe frostbite in soldiers [4]. Since then, such a large number of frostbite was not reported in medical literature as seen in Kashmir during recent past. The present study was planned to evaluate different modalities of management of cold injuries at local hospital that involved gradual rewarming, administration of vasodilators and surgical intervention like limited wound debridement, dressings and amputation as the last resort.

The Pathophysiology of frostbite involves severe vasoconstriction leading to the decreased

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capillary perfusion and development of local stagnation of blood, hyperviscosity, hypoxia and metabolic acidosis. Frostbite involves the extra cellular space first where growing ice crystals cause an increase in osmolarity of interstitial fluid and intracellular dehydration by passive diffusion of water through the cell membrane. Ultimately it leads to cell death [1,2]. At the later stage when permanent damage is evident it leads to the progressive vascular necrosis.

MATERIALS AND METHODS

In this study 2645 patients suffering from frostbite were evaluated. The patients had sustained cold injury during the movement alongside mountain ridges in Kashmir at subzero ambient temperature. The most of these patients were young males of all age groups however, there were a number of female cases as well. They were inflicted by the cold environment during crossing the frozen valleys at high altitude.

While traveling at high altitude alongside Himalayan mountains these patients faced stressful conditions and some of them lost their way during heavy snowfall or got tired in trackless jungles and took shelter in some cave or just under the tree where it was virtually not possible to protect oneself from bad weather and frostbite.

On arrival in the casualty department, most of these patients were found psychologically depressed and anxious with poor general physical condition. Most of them were malnourished, dehydrated and had problems like diarrohea and vomiting. In addition, some of the cases had suffered inhalation injuries during an attempt to rewarm them.

Out of the total number of cases, 139 patients presented with badly infected frost bitten wounds whereas 34 patients had other associated injuries. About 1/3rd of patients with moderate frostbite had deceptive clinical impression of gangrenous limb requiring immediate amputation whereas after few weeks of management, in the hospital viability of tissue was assured. On arrival many patients presented with a clinical impression requiring below knee amputation but after a few weeks of conservative treatment, mid tarsal amputation or the amputation of toes were carried out thus saving the functionally the major portion of the foot.

Initial management of patients was carried out irrespective of the degree of the frostbite. It included the emersion of affected limb in a locally designed water tank with temperature ranging between 41 – 43 0C, for 15 – 20 minutes, [1,3,5,6] initially 8 hourly and later 12 hourly followed by re-warming with application of sterile petroleum gel, application of sterile cotton gauze, wrapping in bulky cotton wool and application of loose bandage. All these patients were kept under strict observation and active movement of joints was encouraged. All patients with severe and moderate frostbite were advised low dose aspirin 150 mg/day [8]. Optimum hydration was ensured by correcting the fluid and electrolytes losses alongside fulfilling the nutritional deficiencies. All patients with severe frostbite were prescribed 150mg ranitidine twice a day to prevent stress ulcers.

The patients with moderate and severe injuries were administered three prophylactic does of one gram intravenous cephradine, while those who had infected wound were administered antibiotics according to their culture and sensitivity reports. In addition, all the patients were vaccinated for tetanus prophylaxis [8].

Low dose nifedipine 5mg daily for 2 weeks was given to 625 patients suffering from severe frostbite and to 541 patients with moderate degree of frost bite [7].

Forty two patients of severe frostbite did not respond to nifedipine and gradual rewarming for over three weeks, who were later given the single dose of 5ml of lignocain intra arterially in local feeding vessel. Whereas in cases of severe low limb frostbite 5ml lignocain (1%) was directly administered in femoral artery. The aim of intra arterial lignocain was to release prolonged small arterial and arteriolar spasm.

Amputation was performed only in those patients in whom all the conservative measures failed to salvage the tissues and even after waiting for several weeks till a clear line of demarcation appeared between the live and dead tissues [9].

RESULTS

All the cases of severe and 1/3rd patients of moderate frostbite who had deceptive clinical impression of gangrenous limb on arrival,

improved clinically after a few weeks of treatment and tissue viability ameliorated. Those patients who seemed to require below knew amputation on the initial examination, responded to the conservative treatment and bulk of the tissue improved and became viable leading thereby to amputation of feet at mid tarsal or toe(s) only. Whereas some of the patients completely recovered without significant tissue loss. All the patients of severe and moderate frostbite were accompanied by some degree of dehydration, malnutrition or gastrointestinal problems and other associated injuries requiring additional management.

The rate of complications of severe and moderate frostbite was quite high even after different modalities of recommended measures. Residual problems of frostbite including post frostbite painful limb syndrome like complex regional pain syndrome (CRPS) and Raynaud's phenomenon were very difficult to manage and presented as a challenging problem to the treating physician. Special problems were encountered in patients with painful stump and phantom pain below knee and mid tarsal amputation. Post frostbite discolouration of hands and face remained an unresolved problem in our cases. Nearly 50% of the patients developed residual problems with one or more complications of various degree and amount.

During management of the patients, the initial resuscitation, gradual rewarming and assessment of the grade of injury played a vital role in the outcome of treatment. Selective use of anticoagulants and antihrombotic agents or spasmolytic drugs, were important for the prevention of complications and helped to improve the outcome.

Gradual rewarming was an effective and promising tool in our study. The wound care was an important and determinant factor for the outcome. Delayed amputation and early conservative debridement was an essential part of the wound care in our study. Therapeutic use of antibiotics was required in infected cases only. Post frostbite complications, including Raynaud's phenomenon, contracture formation and the level of amputation were found significantly low in patients who were taking Nifedipine. Post frostbite Raynaud's phenomenon was encountered in 186 patients who did not receive nifedipine and in 24 patients who had taken 5mg nifedipine daily for 3 weeks. Both the groups of patients had similar clinical presentations on arrival.

Rehabilitation was also very important part of the management which was carried out by the treating surgeon along with other concerned specialists. To prevent the contracture formation and deformities, early mobilisation of the limb was exercised.

Two patients developed non-healing ulcers on the lower leg and required cover by rotational flaps. One patient had gangrene of the part of pinna of right ear and required plastic surgery. The patients with mid-tarsal amputation of foot were advised orthopaedics shoes and those who lost their toes were advised to wear common shoes, after training and rehabilitation. The patients (n=129) who developed contracture and scar, required plastic surgery and 39 patients developed painful limb like complex regional pain syndrome advised long term pain management by the pain care specialist.

DISCUSSION

The factors playing important role in promoting frostbite were studied. It was found that lack of protective clothing, physical exhaustion, moisture, subzero atmospheric temperature, high velocity winds, malnutrition, habit of smoking, presence of coexisting injuries, incapacitation and inability to seek aid or shelter in time loss of guidance and entrapment in snow storms, were the major factors contributing to the development of frost bite [1,3,4,10].

Categorization of patients based on severity of injury in to four major groups (mild, moderate, severe and complex injuries) helped in design of correct management and to take care of the complications to improve prognosis of frostbite. The management of frostbite includes pre hospital care by prompt evacuation of the patient from the site of injury, protection of unharmed tissues to prevent the ongoing losses due to cold insult. Wound management is of paramount importance. Periodic wound examination, evaluation of the viability of the injured tissues, conservative debridement of dead tissues and thorough daily wound toilet were important measures. Daily wound irrigation and immersion of limb in warm water followed by light occlusive sterile dressings

provided the ideal environment for wound healing and contributed to relieve vasospasm in the injured tissues [5,9,11]. Aspirin is always useful. However, in severe cases, the use of heparin in therapeutic doses and tissue plasminogen activator in selected cases at the time of arrival in hospitals has helped in saving the limb and reduced severity of complications of frost bite [10].

As soon as the edema subsides, the patient must be encouraged to perform active exercise in the bath to prevent tendinous retraction. Blisters need to be respected. If they are infected then antibiotics are given [4,8,12]. Nifedipine 5mg daily helped in reducing the incidence of Raynaud's phenomenon, painful limb syndrome and significantly contributed in limb salvage by reducing local vasospasm. In amputates after surgical reconstruction of the stump, good functional recovery was achieved [12].

Pain, hypo or hyperasthesia, hyperhydrosis, finger ankylosis, Raynaud's phenomenon and painful limb were the persistent sequelae and were resistant to all sorts of therapeutic measures. Long term follow up of these patients revealed late complications of frost bite like osteoporosis and early arthrosis due to cartilage damage [10,11,12].

As a principle, the frostbitten part of the body should never be exposed to hot water or open fire, or excessive dry heat as in an oven, because of the loss of sensitivity in the frozen area that makes it especially vulnerable to injury. Warming in water is much more effective and safe than application of warm blankets. Three to four times daily immersion in warm water adds extra benefits by reducing bacterial load in the wound and in passive removing of debris from the wound [6,13].

Prevention remains the essential requirement for those who are exposed to freezing atmospheric temperature. Outcome of cold injury is very much dependant upon the severity of injury and ways and means by which the patient is managed [6].

CONCLUSIONS

There should be no hurry is surgical intervention in patients of cold injury. Local wound care and general care of the patient are important therapeutic measures in reducing over all sinister effects of frost bite [3,4]. Gradual rewarming in warm water is beneficial in most of the cases. Low dose nifidipine has proved its effectiveness in saving the injured limb and preventing the complications of frostbite. Whereas, aspirin and anti coagulants are beneficial in reducing tissue loss.

In selected cases intra arterial low dose lignocain in the feeding artery of the injured limb is also useful therapeutic tool to relieve the chronic vasospasm due to frost bite.

Post frost bite complications like painful limb syndrome, skin discolouration, contracture of muscles and Raynaud's phenomenon were very difficult to manage even with multi disciplinary therapeutic approach.

Table-1: Age and sex distribution

Age groups	1 – 12 years	13 – 30 years	> 30 years
Male	93	1793	531
Female	11	49	87

Table-2: Categorization of patients according to the severity of cold injury

Category	Number of patients
Mild	227
Moderate	1082
Severe	1255
Complex	81

Table-3: Sequelae and residual effects of prostbite

Sequelae	No. of patients
Gangrene of pinna of ear	1
Non healing ulcers	2
Below knee and sym's amputation	7
Mid palmer amputation	11
mid tarsal amputation	13
Amputation of one or more toes of foot	17
Amputation of one or more fingers of hand	19
Painful limb	39
Contracture and Scarring	129
Post frostbite Raynaud's Phenomenon	210

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