Management of effects of heat—need for change

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Heat stress has posed a significant health problem for troops throughout the history of warfare. Egyptian failure to implement adequate precautions against heat stress contributed to quick Israeli victory in the 1967 conflict in the Sinai desert.¹ In India, >3,194 deaths due to heat stroke have been recorded over the five-year period between 1999 and 2003.² More recently, apprehension have also been raised regarding the world climate changes and global warming which may increase the incidence of heat-related illnesses in human population across the globe.³ It has been estimated that the massive heat wave that swept over Europe in 2003, claimed >35,000 lives, with France accounting for 14,000 deaths.⁴ Hyperthermic brain injury is the third largest cause of brain-injury-related deaths, next to cardiovascular and traumatic diseases.⁵

Heat has a broad spectrum of effects but heat stroke and heat exhaustion are potentially life-threatening emergencies which in the Armed Forces are generally treated in the field, and often go unreported. Despite the advances in medicine, mortality due to heat stroke continues to be as high as 10–50%.⁶ The reported hospital admission rate for the army ranges from 0.17 to 0.43 per 1,000 for the decade 1999–2009. Heat exhaustion contributes to >90% morbidity of effects of heat. Effects of heat is ranked fourth in disease-wise outbreaks with a total of seven incidents (outbreaks) affecting 144 individuals between 1993 and 2009 in the Army.⁷ Numerous cases often go unreported which are treated at the outpatient department (OPD) level and recover. A study on morbidity amongst recruits reported an incidence of 1/1,000 (range 0.25–1.64) in the training centres.⁸

High ambient temperature, high humidity, and lack of air movement are ideal environmental conditions for effects of heat to occur. Besides this, physical exertions, poor hydration, and certain other factors like drugs and co-morbid conditions like overweight and obesity predisposes an individual to effects of heat. Armed Forces personnel are at risk for effects of heat during training, in deployment or operations. The working conditions, equipment they handle, the uniform they wear for camouflage further predisposes them to effects of heat.

In Western and central parts of the country temperature touches an high of 50°C and more with relative humidity not >30%. The central and northern plains, western deserts, and tropical forest areas of Northeast have environmental conditions predisposing soldiers to effects of heat stress. There is also a growing body of evidence that heat stress that is physiologically tolerable can impair human ability to accomplish complex tasks of military importance.⁹

Medical personnel must be prepared to advise commanders on the potential adverse effects of heat and to propose practical options for prevention and control of heat stress under difficult circumstances. They must be aware of all relevant orders and instructions on the subject. All cases of effects of heat including deaths must be investigated. Exhaustive preventive measures to combat effects of heat stresses which are implementable at unit and individual level are clearly laid down in Army Orders and Manual of Health for Armed Forces. Instructions are also documented to reschedule training and physical activities to avoid heat stress on troops. The implementation of relatively simple preventive measures can have a dramatic effect on heat illness rates in military settings.¹⁰ Acclimatisation, BPET in cooler parts of the day, and pre-BPET medical appraisal can be effective in reducing effects of heat.

Conventionally, cool rooms and heat stroke centres (HSCs) are authorised in the army to tackle cases of effect of heat. The peripheral healthcare establishment (HCE) like medical inspection rooms (MI rooms) and medical aid posts (MAPs) are authorised to establish HSCs and cool rooms during summer months (April–September) to render first-aid and treatment nearest to the site of casualty provision exists to procure ice for cooling purposes at the scale of 45 g/diem/man when soldiers are required to stay in tents and bashas.¹¹ For each HSC and cool room ice is procured, varying from 200 to 400 Kg in quantity, for the period ranging between April and September to keep room temperature near comfort zone and use cool water to render first-aid. The practice of using ice in HSCs and cool rooms for control of ambient temperature is not only inefficient but uneconomical. The number of HSCs and cool rooms sanctioned in the army for financial given year are 230 and 1,115, respectively. On a conservative estimate about 300 Kg ice is procured for each cool room daily for 180 days. The approximate rate (contract rate) of ice is ₹2/Kg. With this the expenditure incurred to the exchequer on one cool room for six months duration is ₹1,08,000/(2×300×180) and this is a recurrent annual expenditure. The total annual expenditure on all such cool rooms and HSCs works out to be approximately ₹1,338 lakhs (13.3 crores). The prevailing practice of establishing cool rooms at peripheral HCE in built up locations is

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not only inefficient but highly wasteful with associated logistical problems. It is time that such absolute cooling measures should be done away with and modern cooling appliance is introduced in our healthcare facilities. The modern appliances like air conditioner, refrigerator, and walk in cooler are more economical, efficient, and user friendly. The latest scales of accommodation has made provisions of air conditioners for MI rooms which need to be made use of.¹² It is about time for medical authorities to recommend modern cooling appliance and gadgets to all peripheral HCE to provide effective medical care to our clientele. The provisions of cool rooms should be kept reserved for contingencies when these modern gadgets are not feasible to use like when under move or operational mode. A suggestion has also been made on the need of a 'heat stroke van' like a coronary care van in the Armed Forces.¹³

Another aspect of prevention of effects of heat stress that needs to be addressed is wearing of clothing suitable for climate which helps in maintaining the body temperature. The present system of same synthetic (polyester) fabric being used in all climatic conditions (except heat acclimatisation of athletes [HAA]) needs to be revisited. The clothing with low insulation, high permeability to moisture, and low absorption is suitable. The recommendations are that we use light coloured loose fitting clothing, in one or two layers made of 'breathable' material like cotton. Synthetic material has poor permeability and is to be avoided. Similarly, multilayered clothing traps a layer of still air between them and tends to increase the insulation even if they have good permeability. The host factors like physical fitness, acclimatisation to hot weather, avoiding alcohol, and adequate hydration are critical for prevention of effects of heat.

RECOMMENDATIONS

The practiced system of establishing cool rooms and HSCs must be replaced by modern cooling systems like the use of refrigerators, air conditioning, and deep freezers to achieve the optimum efficiency. Training of medical officer and paramedical personnel in the management of effects of heat requires to be given attention as early and effective first-aid can be lifesaving. This can be accomplished by incorporating topics of environmental emergencies during training of medical UGs, interns, during basic course and also for paramedics at the AMC Centre and College and during BFNA training for the soldiers at formation and field hospital level. It would also be pertinent to revisit our varied instructions and compile them and produce a comprehensive document on prevention of effects of heat in soldiers especially with increased emphasis on preparedness

against NBC warfare in the changing climatic scenario. Personal cooling garments with air- or liquid-based systems⁹ have also been designed and described in the US Army which can be thought of for recommendation under NBC scenario. There is also a need to develop surveillance system for heat illnesses and research into the field of environmental medicine with the Armed Forces perspective in mind.

CONFLICTS OF INTEREST

None identified.

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