OP TELIC

Heat Illness on Operation Telic in Summer 2003: The Experience of the Heat Illness Treatment Unit in Northern Kuwait

JPG Bolton, PH Gilbert, C Tamayo

ABSTRACT

In the mid-summer months of June and July of 2003 some 6000 British Troops deployed to northern Kuwait to heat acclimatise in preparation for the relief of Forces then deployed in Iraq who had recently fought in Operation Telic. This paper outlines the clinical presentations and primary care management of heat illness as seen at a specialist Heat Illness Unit that had been collocated with the acclimatisation camps. It discusses the limitations within current MOD heat illness guidance and makes general recommendations for future deployments. Whilst it was seen that the perception of risk by senior Commanders and the pre-deployment preparation was correct, the extreme temperatures seen, averaging 46ºC, still resulted in a heat illness rate of 50/1000 during the first 10-14 days of deployment.

INTRODUCTION

In early 2003 some 43000 British Troops deployed to the Arabian Gulf to take part in operations to liberate Iraq from the Ba'ath party regime under the overarching operational name Telic. Operation Telic 1 consisted of the movement of troops to the region, the war fighting phase, and the immediate consolidation post-hostilities. Operation Telic 2 was the replacement of these units with a fresh force for the prosecution of subsequent operations.

This paper describes the management of heat casualties arising among troops newly arrived in theatre in the height of summer. It discusses the historical perspectives; the rationale for a specific primary care (Role 1) based heat illness treatment facility; the guidelines for the management of climatic injury; the establishment and running of the facility and the clinical management of cases.

Historical Perspective

Historical records show that British forces have suffered considerable morbidity in this region previously. In 1917 in Mesopotamia (1) a force of 83000 British troops suffered over 6000 admissions to hospital (75 per 1000) and there were 524 deaths including 423 in a 3-week period in July. In 1942, troops serving in Persia and Iraq were experiencing 14.98 admissions per 1000 compared with an incidence of 2.56 in 1945 (2). None of these figures shed any light on the incidence of heat illness amongst newly arrived troops which would have been their most vulnerable time albeit that, deploying by troopship many would have been acclimatised by their time of arrival. In 1961 the Army Operational Research Group found that troops deployed, on Operation Vantage, to the Kuwait border in response to aggression from Iraq suffered 132 cases of heat illness in the first 47 days. Those deploying from Cyprus suffered 2.9% heat casualties whereas in those deployed from UK the incidence was 9.5%. Since those days, there has been a marked reduction in large operational deployments of British Forces into extremely hot climates with a consequent loss of experience. The Gulf conflict of 1991 occurred in February and March when conditions were considerably cooler. The most recent experience was on Exercise Saif Sareea in the Oman in the autumn 2001. Routinely collected morbidity data (J97) indicated that the overall primary care consultation rate for heat illness during the exercise was in the region of 24 per 1000 per month.

The Estimate

The process by which a military mission is formally analysed to produce a plan is known as The Estimate. The task was to provide medical cover to some 6000 newly arriving troops conducting acclimatisation and training in an isolated staging area in northern Kuwait before deploying into Iraq. A further 2000 troops were to deploy directly to their operational locations in Iraq. This commenced in early June, and the incoming troops were to be in position by late July.

For those arriving for Operation Telic 1 from the UK and Germany in February and March weather conditions were unpleasantly hot. Temperatures were in the mid- to upper-30s°C, but fell to below 10°C at night. Despite the force deploying from a European winter and rapidly embarking on offensive operations, the number of heat casualties was in single figures. Although the temperature transition was sudden it was of only moderate magnitude, and there was guaranteed

Colonel JPG Bolton L/RAMC, Defence Medical Services Department, Ministry of Defence, London WC1A 2SH
Tel: 0207 305 4680
Fax: 0207 305 4099
E-mail: phil.bolton447@mod.uk

Lieutenant Colonel PH Gilbert RAMC
256 (City of London) Field Hospital (Volunteers) 71 Braganza Street, London SE17 3RF

Surgeon Lieutenant Commander Brando C C Tamayo, Department of Anaesthesia, Salisbury District Hospital, Odstock Road, Salisbury SP2 8BJ

respite with low night temperatures. Operation Telic 2 posed altogether different problems, as the forces were deploying when temperatures were rising towards their summer peaks of 50°C. There had been cases of acute heat stroke arising soon after arrival amongst small numbers of individual reinforcements whose deployment resulted in them joining their units directly and acclimatising *in situ*. It was clear that these were cases of classical heat stroke. These cases served as a further warning that the climatic conditions posed a hazard to newly arrived personnel.

For operational reasons 202 Field Hospital (Role 3) had moved forward from Kuwait to a position west of Basra in Iraq in mid May, which left the reception and staging area one hour away by road from the US Army Role 3 facility in Kuwait City and two hours from 202 Field Hospital. Further, due to the magnitude of the temperature and the potential for sand storms, helicopter support could not be relied upon. On the basis of distance, these potential transport limitations, historical data, and the population at risk it was concluded that medical support in the staging camp should be an enhanced primary care facility (Role 1 in military terminology) with a minimum of a 25 bed holding facility. Whilst a Role 1 node already existed at the location this was not at the capability level required and was therefore enhanced in terms of personnel, tentage, and equipment. The transport assets, comprising two air-conditioned Land Rover Battlefield Ambulances (BFAs) were doubled, and an air-conditioned coach was added.

The provision of a suitable medical facility was to be coupled with a risk communication exercise. This was to ensure that Commanders of incoming units were fully aware of the threat posed by the climate and the requirement for acclimatisation. The recommended acclimatisation programme began with three days of minimal activity followed by gradually, strictly supervised, increasing activity in the cooler periods of the day, aiming to reach full capability by day fourteen as a compromise between what might have been medically desirable against what was operationally necessary.

Definitions

We used the general term Heat Illness for all casualties incapacitated by heat-related symptoms regardless of body core temperature. Heat Stroke is defined (3, 4) as a Heat Illness with the two critical factors of a reduced level of consciousness and a core temperature in excess of 40°C. Role 1 is essentially primary care and Role 3 is hospital care.

Guidelines

The current Ministry of Defence (MOD) guidelines on prevention and management of heat illness (5) were updated and published in January 2003 as Joint Services Publication 539 (JSP539). As will be discussed it was felt that these guidelines primarily dealt with the prevention of exertional rather than classical heat illness. Specific advice on classical heat illness, its prevalence in military forces and any preventive measures was more difficult to obtain.

THE HEAT ILLNESS UNIT

Medical Facilities

Whilst incoming units deployed with their own medical personnel, they provided only basic support. Most of their equipment was dispatched separately and the medical staff were still un-acclimatised. The Heat Illness Unit (HIU) consisted of a 6 bay resuscitation and general primary care area (Figure 1) and a 25 bed holding ward (Figure 2). Both were in air-conditioned, heavy, twin-layer marquee-type accommodation tents. At full strength the personnel consisted of The Senior Medical Officer (SMO), a senior GP in overall charge of both the HIU and all Role 1 Care in Kuwait and Southern Iraq, the Resuscitation Officer, a Royal Navy anaesthetist who assumed day to day responsibility for the running of the facility, a General Duties MO, two Nursing Officers (NOs), and eight Combat Medical Technicians (CMTs). The ward staff were seconded from Role 3 and consisted of three NOs and one CMT. The ward had 16 field hospital and 9 camp cot type beds. The latter were used for non-heat illness, particularly diarrhoea and vomiting, cases so as to prevent cross infection.

Figure 1. Resuscitation Area

Figure 2: Ward area

Equipment

The core of the resuscitation equipment was from a single BFA module. This was supplemented by numerous non-medical items such as electric fans and water spray bottles that were obtained through local purchase. "ProPaq" multi-monitors were also of great importance as they allowed quick, accurate, and reproducible measurement of blood pressure, haemoglobin oxygen saturation, heart rate, ECG and respiratory rate. Standard temperature measurement was by simple, cheap electronic thermometers although mercury and infra-red tympanic devices were also available.

An i-STAT Portable Clinical Analyser (Figure 3) was sourced from Role 3. This provided measurements of blood sodium, potassium, chloride, bicarbonate, haemoglobin and haematocrit, as well as pH and blood gases. Unfortunately it was available for only the last 10 days of the operation.

Figure 3: i-STAT

Raw temperature data and Wet Bulb Globe Thermometer (WBGT) heat stress indexes were measured on a QUESTemp °34 Thermal Environmental Monitor.

MANAGEMENT

Clinical Management

All patients were initially assessed and resuscitated along standard ABC lines. Simultaneously they were stripped and water-mist-fan cooled. On aggressive cooling an estimated 1 in 5 patients shivered. In this situation cooling was reduced to fanning only as shivering may induce heat generation. All patients with significant symptoms and or a raised core temperature were intravenously cannulated and received one litre of cool crystalloid. After this only patients with a clinical requirement received further intravenous fluids. Whilst capillary glucose was measured as routine, significant hypoglycaemia was uncommon.

Patients were transferred to the ward when they had symptomatically improved and their core temperatures were below 38°C. Those with heat stroke were evacuated directly to Role 3 by helicopter. All other heat illness patients were held on the ward for between 8 to 20 hours. The holding policy was for a maximum 24-hour stay. Patients with persisting symptoms 24 hours after admission, with recurrence of severe symptoms, or with abnormal blood electrolyte values (once these could be measured) despite intravenous or oral therapy were transferred to Role 3.

Patients were returned to their units when they were symptom free, had blood electrolytes within normal limits, and had rested for a minimum of 8 hours. A combination of 2 to 4 days of strict non-air-conditioned tent rest, followed by 3 to 5 days of gradually increasing light duties were prescribed depending on the severity of the symptoms.

Clinical Records And Data Collection

Clinical summaries were recorded on both the casualty's Operational Medical Record (F Med 965) and the HIU central record (B Med 33). JSP539 heat illness report forms were also completed and forwarded through the Chain of Command. For the purposes of this study a specifically designed statistical collection form was completed for each casualty (Figure 4). This additional form was used to narrow down the answers to the open questions on the JSP report form as well as to record specific additional information such as the number of days in theatre and the time spent in the HIU.

HEAT ILLNESS STATISTICAL COLLECTION

To be completed for all patients with suspected or confirmed hat related illness.

If RTUed directly or admitted to 202 Fd Hosp directly please complete before the patient leaves the med centre.

If admitted to the ward at Coyote, please complete before the patient leaves the ward.

NUMBER RANK NAME INITS UNIT

DATE AND TIME SEEN DAYS IN THEATRE ACTIVITY

Rest/Light driving heavy work PT

PREDISPOSING FACTORS FLUIDS SYMPTOM DURATION

Age >45 sleep weight alcohol diet adequate inadequate <24hrs >24hrs

SYMPTOMS dizziness exhaustion vomiting cramps headache

Collapse with no LOC LOC hyperventilation nonspecific/other

RECTAL TEM MEASURED RECTAL TEMP BEST ESIMATE BP GLUCOSE

COMMENTS (eg abnormal sats GCS etc)

ROLE 1 DIAGNOSIS

Heat intolerance heat exhaustion heat hyperventilation heat cramps heat stroke (>40)

PRESENTATION IVI (litres) DISPOSAL FROM MED CENTRE

1st 2nd 3rd 4th 0 1 2 3 direct RTU hold & RTU hold & 202 direct to 202

IF HELD AT COYOTE, HOURS HELD RESTRICTED DUTIES (DAYS)

<4 4-8 8-12 12-24 >24 not known 1-2 3-7 >7

COMPLETION BY SMO AFTER 202 DISCHARGE

DAYS AT 202 RTU casevac

1 2 3 >3 RTU casevac

Figure 4: Data Collection Form

RESULTS

Environmental Conditions.

The average temperature and humidity readings were:

	Dry Bulb	WBGT	Relative Humidity
Day	46°C	34°C	8%
Night	37°C	26°C	18%

The Activity Graph at Figure 5 illustrates the attendances per day of Operation in relation to the number of troops in the staging area (Population at Risk [PAR]) and the daily temperature.

The pie chart at Figure 6 shows the breakdown of cases by rectal temperature at presentation to the HIU. As many patients had received effective first aid before arrival and often the time between presentation and arrival at the HIU was unknown, the results will not be representative of temperature at initial onset. The charts at Figures 7 and 8 show the frequency of activity in the period leading up to presentation and symptoms at presentation.

The Heat Illness Unit dealt with 300 heat-related presentations during the operation which lasted for one month. During this month approximately 6000 troops passed through the staging area. Their average duration of stay in the area was about 10 days, thus suggesting an incidence of heat illness of 50 per 1,000 in the first 10 days in theatre. They then moved on to other parts of the

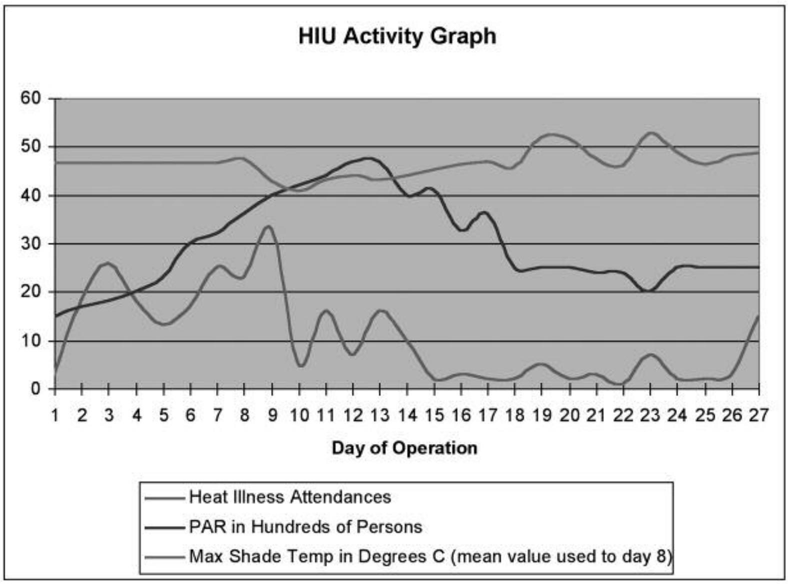

Figure 5: HIU Activity Graph

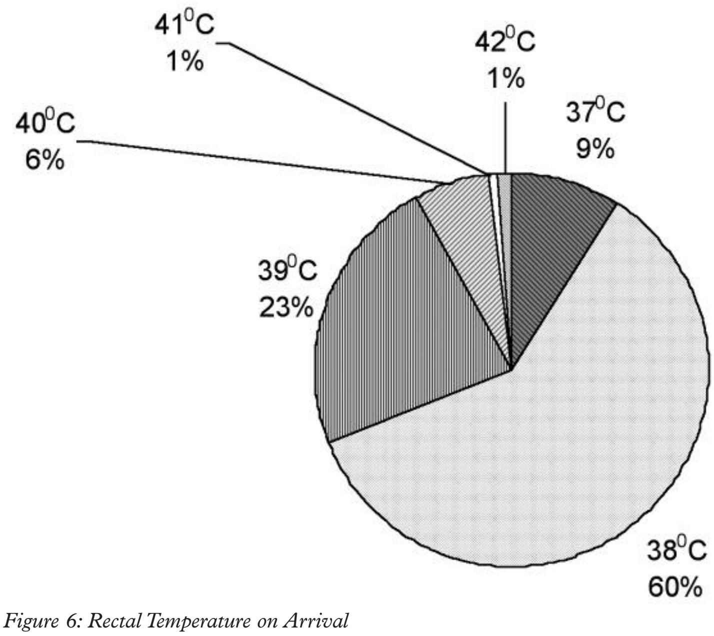

Figure 6: Rectal Temperature on Arrival

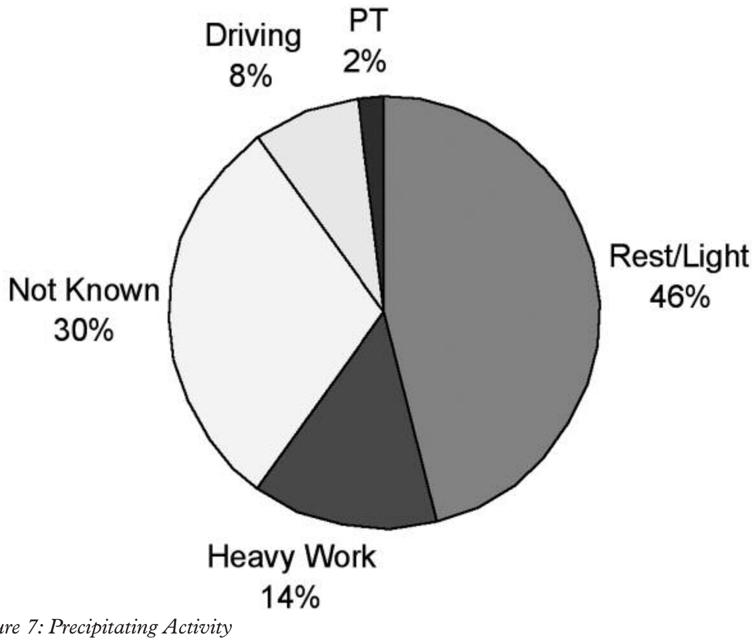

Figure 7: Precipitating Activity

area of operations and beyond the scope of this project. Data on the number of days in theatre at time of presentation reveals that 90% presented within their first 10 days.

Five patients presented with heat stroke. All vomited during resuscitation, 3 had seizures and 2 showed clinical signs of pulmonary oedema. Two patients became combative on rousing with cooling and required sedation to facilitate early aero medical evacuation.

Sadly the i-STAT analyser arrived too late in the operation for the collection and inclusion of any meaningful electrolyte data.

The pie chart at Figure 9 shows the outcome of the cases in terms of their disposal at discharge.

DISCUSSION

This paper describes the establishment of a Role 1 medical facility for the management of heat illness in an acclimatising military population deploying on operational duties into an area with minimal infrastructure and very little respite from the environmental conditions. The facility evolved with experience. We have reported the clinical findings of the patients seen in the HIU. Because of the discrete nature of the PAR, its remoteness from alternative sources of medical care and the threat that heat illness posed, we believe that we saw all patients in the PAR who needed treatment for heat illness during acclimatisation training. However, acclimatisation training was a transient activity and, once complete, the PAR moved to its operational locations and the HIU was closed. It was not possible to follow the patients up once they had either been discharged or evacuated to Role 3.

For the planning of future operations an important but limited conclusion can be drawn. In the event of a similar deployment into summer desert conditions with minimal infrastructure and respite, the number of heat casualties sustained during acclimatisation in the first 10 to 14 days in theatre will be approximately 50 per thousand troops deployed.

The limited experience gained from earlier and smaller deployments of personnel to Operation Telic indicated that classical heat illness was likely to be the main cause of morbidity, rather than exertional heat illness, with which there is a high degree of familiarity within the Services. Information on the preventive aspects of this condition was hard to come by. JSP539 deals largely with the prevention and treatment of Exertional Heat Illness. This is seen commonly in the UK in the military, civil emergency services, and in industry. It occurs in people performing heavy work often wearing protective clothing in high humidity and/or moderately high environmental temperatures. Soldiers on a combat fitness test in the UK summer or marine engineers working in machinery

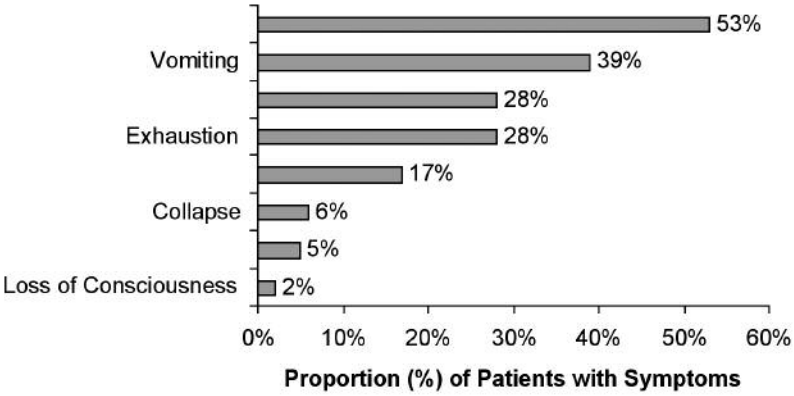

Figure 8: Frequency of Presenting Symptoms

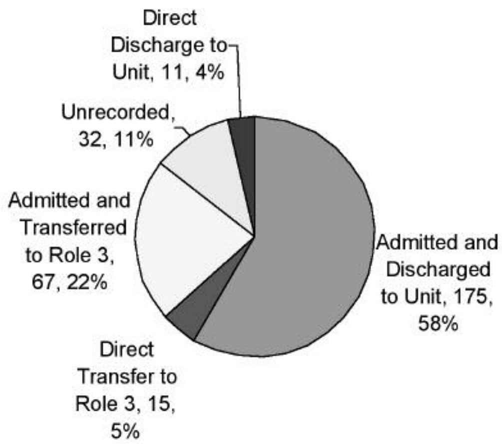

Figure 9: Outcome

spaces aboard warships would be good examples. Environmental temperature need not be particularly high and the use of the WBGT heat stress index is well known to prevent casualties. The prediction of classical as opposed to exertional heat illness was correct and only 14% of the heat casualties seen at the HIU had been engaged in heavy activity at the time of collapse.

What was encountered in Kuwait was Classical Heat Illness, where troops became ill at rest simply due to extreme environmental temperatures. 46% of the casualties were resting or engaged in very light activity at the time of collapse. In this context an activity such as driving which is described in JSP 539 as a low risk activity can be very high risk indeed. 8% of the soldiers seen had driving recorded as the precipitating activity. Very few UK Military vehicles are air-conditioned and cab temperatures can become dangerously high.

Because of the location of the HIU in the centre of the PAR it was possible for medical staff to monitor adherence to the advice given about acclimatisation and the impression was that there was a high degree of compliance. Only 2% of those seen were taken ill during PT, which was conducted responsibly and at sensible times of day. A few individuals were exercising over vigorously and against unit orders. The advice on adequate oral fluids was adhered to closely by troops and supplies of bottled water were generous. Soldiers often reported missing meals, feeling that it was too hot or they were too tired to leave the shade.

Temperatures were so high that heat stress indices fell outside the work guidance tables published in JSP 539 for much of the time, and indeed these tables may be misleading in extreme heat. For example guard duty is an activity that has to take place whatever the environmental challenge. In JSP 539 it is shown as a low energy generating and low risk activity. In the desert environment the soldier on guard is highly susceptible to the direct effect of radiant heat. His exposure time must be limited and he must be carefully monitored. It is felt therefore that, since JSP 539 is intended for lay as well as medical readership, there is a case for additional advice with regard to classical heat illness and its prevention.

The majority of the cases treated barely fulfil the diagnostic criteria for heat illness. 69% had a rectal temperature of less than 38°C at presentation to the HIU. This may be because many had received effective first aid during transit. Alternatively the authors speculate that in Classical Heat Illness the debilitating environmental conditions along with the other factors discussed may cause exhaustion and collapse with lower core temperatures than those found at the point of collapse in exertional heat injury. Over half of the casualties presented with non specific dizziness. 40% of them were vomiting which of course compounds dehydration and any electrolyte disturbance. The two other most common symptoms, each affecting about a quarter of the casualties were headache and non specific exhaustion. What is certain is that these soldiers were sufficiently ill to be incapable of performing the most basic military duties or even self care and individual routine. They needed substantial medical input to enable them to return in due course to duty in their units.

Lack of sleep and rest are very well recognised precipitating factors. The tiring and dehydrating effects of the outward deployment journey were the reason for imposing a three day period of rest and minimum activity followed by a gradual work up to operating capability over the next 10 days. Even with this imposed by all units, ensuring sufficient rest was difficult. Whilst the WBGT readings observed allowed for only negligible daytime activities according to the advice contained in JSP539, it was possible to work at night or in the early morning. However it is difficult to sleep or rest in the daytime heat. Rest periods for troops during acclimatisation need to be carefully planned. In these austere conditions some sort of respite from the daytime heat, such as air-conditioned coaches or tents should be provided.

The most efficient method of cooling

appeared to be the delivery of a fine water-mist from garden water spray bottles, with subsequent fan assisted evaporation from free standing electric fans. The authors subjective experience was that cold water sponging, and hence conductive cooling, is less efficient than evaporation. It is also the perception that sponging is more likely to produce shivering which counteracts the cooling efforts.

In response to security threats and incidents, there were periods when vehicles crossing into Iraq had to move in pairs with 4 armed occupants. This added a further dimension to clinical decision making regarding Role 3 evacuation. The coach proved invaluable for moving larger numbers of patients. Its air-conditioning was significantly more efficient than that of the BFAs, which, even when working at full capacity, could not sustain a temperature below 35°C in the stretcher compartment.

Fluid therapy needs to be evaluated further. Experience from this operation suggests that varying degrees of dehydration complicate most cases of heat illness. The administration of 1 to 2 litres of cool crystalloid appears to benefit most non-heat stroke patients and carries little risk of problems.

Whilst heat stroke is uncommon it represents the life threatening end of the spectrum of heat illness. All patients should be managed along standard ABCD lines but with core temperature recording and aggressive cooling started as soon as possible. In heat stroke fluid therapy must be given on an individual patient to patient basis, but there seems to be a very significant risk of pulmonary oedema, both from over-infusion and from natural disease processes.

The original mission plan did not envisage the need for an anaesthetist. Airway management was therefore to be by simple manoeuvres, suction and airway adjuncts alone. It is noted, however, that all heat stroke patients required hands-on airway care to some degree. While immediate and aggressive cooling is vital, early evacuation to an ITU capable unit is equally life-saving. The air or road evacuation of a comatose patient, or a sedated combative patient, without a secure airway represents avoidable risk. Securing the airway of an unconscious patient for safe transfer can only be achieved by endotracheal intubation. This will invariably require sedation, paralysis, and full electronic monitoring. It is therefore recommended that in future similar circumstances an anaesthetist and an anaesthetic module be available, whether this is as part of the HIU or the aero-medical team.

Approximately 2/3 of the casualties returned to their units, mainly after an admission to the HIU. The small number of direct discharges is a reflection of the extreme environmental challenge. Those transferred to Role 3 without admission to the HIU holding facility included the heat stroke diagnoses evacuated urgently.

The i-STAT analyser unfortunately arrived too late in the operation for useful electrolyte data to be collected. Subjectively there can be no doubt that being able to confirm relatively normal electrolyte levels after IV rehydration facilitated admission to the HIU followed by discharge to unit rather than transfer to Role 3. Before this several cases were transferred primarily for confirmation of normal electrolyte balance.

Each patient was evaluated individually with regard to return to duties. It is believed that after an episode of uncomplicated heat illness, 2 to 4 days of strict rest in unit lines followed by 3 to 5 days of gradually increasing light duties best optimised the return to full duties.

Notwithstanding the limitations of the HIU, we believe that its ability to provide local, rapid and intensive treatment to the heat injury casualties arising during acclimatisation saved lives. It would have been of even greater benefit had conditions prevented helicopter evacuation of the serious cases which nearly happened on several occasions.

Prevention of heat illness is better than treatment but if it becomes necessary to conduct a large scale deployment of troops into a hot climate in the extremes of summer then proximity of the staging area where acclimatisation is undertaken to a Role 3 facility should be a consideration. If it is not possible to conduct acclimatisation near to a Role 3 facility then an enhanced primary care facility such as the HIU, coupled to ready access to evacuation assets would be a suitable compromise. One of the main considerations when planning such a unit is ready access to space since it is rare to have isolated cases in the circumstances described. Whilst the majority will not need aggressive resuscitation they will need to be cooled down, observed, rested and given fluids.

RECOMMENDATIONS

Our core recommendations are that:

1. The current advice, for heat illness should be reviewed in the light of our findings, Additional guidance on the prevention and treatment of classical heat illness should be provided to supplement that already available on exertional heat illness. Aspects of return to duties and tertiary referral guidelines should also be addressed.
2. The figure of 50 heat casualties per 1000 troops in the initial acclimatisation period (first 10-14 days) should be accepted in the estimate for any future deployment to this theatre in similar circumstances.
3. In such circumstances an i-STAT or similar equipment should be available and the data collected and analysed to ascertain its value.

4. Acclimatisation in theatre should take place close to anaesthetic/ITU support.

REFLECTIONS

In general the perception of risk by commanders prior to the Operation Telic deployment was correct, and consequently the HIU as deployed was appropriate to the task and saved lives. All the authors found the clinical and military experience gained to be highly rewarding both professionally and personally.

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