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Case Report—Severe Heat Stroke in an Active Duty Paratrooper

By Robert Oyler

Heat injuries, including Heat Stroke, continue to be a substantial cause of morbidity and lost duty time among active duty soldiers. Soldiers in their first 2 years of service have had appreciably higher rates of heat-related injuries than those with more experience and time-in-service. Heat injuries occur in every month of the year; however, they begin to increase in April, and peak during the summer months.

Heat Stroke is a medical emergency resulting in multi-system injury and may affect a person for a prolonged period of time after it has occurred. This case report will discuss a severe case of Heat Stroke in an active duty paratrooper with serious and potentially long-term sequelae.

Case Report

On 20 July 2001, the 3d Brigade, of the 82d Airborne Division, conducted its 12-mile ruck march for the Expert Infantryman's Badge (EIB). The event started at 0200 hours in 74F temperature, with 95% humidity. An aid station was set up, at the end of the 12-mile finish line, for those individuals needing field medical care. Approximately 400 candidates started the event, of which 70 had to be taken to the aid station for IV fluids during or after finishing the ruck march. Twenty-two of those 70 were medically evacuated to the ER of Womack Army Medical Center for further evaluation and treatment, of which 18 were admitted for Heat Stroke that day and the other 4 were admitted the next day.

Several risk factors attributing to the high number of heat injuries have been identified:

1) The ruckmarch started during the dark of night at 0200 hrs. The only water point that was manned was at the 6-mile point. All other water points were unmanned, located

at 2-mile intervals, and were marked with ChemLights, which could not be seen or faded out before the EIB candidates got to those water points. Thus, no water was obtained from those sites because they could not be identified

2) When candidates started taking off their Kevlar helmets because they were over-heating, and/or became dizzy/lightheaded/stumbling, they were not pulled from the ruckmarch. Instead, many senior NCOs (E7s thru E9s) told them to put their helmets back on and/or to "suck-it-up, and drive-on."

3) Some of the candidates emptied their canteens shortly after starting the ruckmarch to lighten the load they were carrying, hoping to get water enroute, only to find out they could not find the water points and therefore became dehydrated and resulted in Heat Injury.

4) Several candidates, at least 5 known to admit to it, and most likely others who would not own up, were taking dietary supplements like Ripfuel, Hydroxycut, Stacker 2, Ephedra, etc. to enhance their performance. Those 5 who took the above supplements became dehydrated and wound up as Heat Injuries.

This case report is about the most serious patient diagnosed with severe Heat Stroke from that event. He is a 20-year old black male E-3 paratrooper, from the Virgin Islands. At the approximate 11-mile point of the 12-mile ruck march, he collapsed with a total loss of consciousness (LOC) and was taken to the ER at Womack Army Medical Center, and was subsequently admitted to Ward 4S. After being stabilized, he was transferred to the University of North Carolina (UNC) Medical Center at Chapel Hill, NC, on 22 July 2004, for the seriousness of his heat stroke, which resulted in acute renal failure requiring emergent dialysis, and significant rhabdomyolysis with concern for

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possible bilateral thigh anterior compartment syndrome.

His most significant lab values were:

<u>Date/Time:</u>	<u>Test/Recorded Values:</u>
20 Jul 01/0651	WBC—31.7 Neut—85 Lymph—4.2 Mono—3.4 Bands—22
21Jul 01/0824	CK—535,933
21Jul 01/0200	AST—4587 ALT—1032
24Jul01/? (UNCMC)	Creat.—32

The patient was dialyzed for about 13 days, for a total of 7 therapies (6 at UNCMC and 1 at WRAMC). His initial IV line infection grew out MSSA, but subsequently became MRSA. He was initially treated with Vancomycin, but transitioned to Nafcillin and developed a transaminitis as a result. He was restarted on Vancomycin and his MRSA resolved. Despite only one treatment of dialysis at WRAMC, his creatinine was 2.5 on discharge. His functional status gradually improved to running about ¼ to ½ a mile, but he still complained of significant residual fatigue. The patient had a Medical Evaluation Board, which recommended medical separation from active-duty, and he was referred to the Physical Evaluation Board at Walter Reed Army Medical Center which gave the patient 10% disability. The patient was medically discharged on 21 Jun 02 with a separation allowance. He did not receive a psychometric evaluation by a Neuro-Psychologist before he was medically discharged from military service. No contact with the patient has been available since his separation and it is not known how the patient is fairing physically or mentally at present.

Discussion

Heat Stroke diagnosis, clinical management and prevention will be addressed in this article. The protocol for Heat Stroke at Fort Bragg, NC, will also be presented, and is offered as a model for others to implement and/or modify at their discretion.

Technical Bulletin Medical (TB MED) 507, Heat Stress Control and Heat Casualty Management, is an excellent resource for medical personnel, and unit commanders/leaders to use for the prevention and medical care of Heat Injuries. This article will present the highlights of exertional Heat Stroke as discussed within TB MED 507 without going into minute detail.

Diagnosis: exertional Heat Stroke is usually characterized by the following:

1) elevated body temperature (>40° C or 104° F, core temperature may be lower if measured after body cooling has occurred). However, Heat Stroke may also occur at lower body core temperatures. {**NOTE:** hyperpyrexia and anhydrosis are no longer considered essential to the diagnosis of exertional Heat Stroke (see Textbook of Military Medicine, Chapter 7, Clinical Diagnosis, Management, and Surveillance of Exertional Heat Illness, *Gardner & Kark*, p. 243). }

2) central nervous system dysfunction resulting in delirium, confusion, combativeness, disorientation, obtundation, amnesia, convulsions, or coma.

3) multi-organ dysfunction, e.g. liver damage, rhabdomyolysis, electrolyte abnormalities, disseminated intravascular coagulation (DIC) or acute renal failure. {**NOTE:** The traditional diagnostic criteria of Heat Stroke: coma or convulsions, hot dry skin, and core temperature above 106°F (41.3°C) reflect experience primarily associated with the classical form of heat stroke. Rigid adherence to these criteria will lead to under diagnosis of exertional heat stroke, since coma, convulsions, and anhydrosis may be late events in exertional heat stroke. Furthermore, patients may receive medical attention after they have had a chance to cool somewhat and regain consciousness, especially if they are still sweating. }

Clinical management of exertional heat stroke begins with the first responder(s), and should always be urgent to prevent the potential for rapid deterioration of the patient. Immediate medical support in the field or garrison may include, at a minimum, measurement of core temperature, brief assessment of vital signs and mental status, and immediate, effective cooling, and transport to a medical treatment facility ASAP. If possible, an accurate record of the clinical description of the immediate events, signs and symptoms, vital signs, and mental status of the patient, along with the environmental conditions and training activities, clothing, and treatment given prior to arrival at the medical facility should be documented.

Early initiation of cooling and rehydration is paramount, especially in a field environment. Cooling may include removal of outer layers of clothing, soaking the skin with water, using wet sheets, ice packs or spray bottles, cool or ice water immersion, massaging the skin, and resoaking.

Rehydration with oral and/or intravenous (IV) fluids is another important step. Oral fluids work well with patients whose mental status is good and who can take fluids without the risk of vomiting. IV fluids replenish the extra cellular fluid quickly, and NaCl may be given in concentrations higher than can be tolerated orally. Patients with clinically significant volume depletion (hypotension, tachycardia at rest, or orthostatic signs) should initially receive normal saline in 200 to 250 ml

boluses. No more than 2 liters of IV fluids should be given without laboratory results, and the composition of subsequently administered fluids should be guided by measurements of serum electrolytes.

Adjunctive therapy requires following the ABC algorithm for stabilization. The patient's vital signs need to be continuously monitored. A rectal probe should be placed to continuously record core temperature. Maintain an IV line for fluid replacement. Urine output also needs to be measured. Patients may develop marked agitation or combativeness, and the sedation of choice for this situation is benzodiazepines. Monitoring of platelet count, prothrombin time (PT), partial prothrombin time (PPT), fibrin split products, and fibrinogen is also indicated. Use of steroids has not been shown to be beneficial, and use of antibiotics should be limited to specific indications, as in other clinical situations.

Prevention of heat casualties falls into several categories:

- 1) *Acclimatization/physical fitness*: should be maximized, especially prior to deployment. Acclimatization takes 7 to 14 days. Physical activity should be increased gradually. Water consumption requirements will increase.
- 2) *Hydration/nutrition*: emphasize and establish mandatory drinking schedules (refer to Tables 3-1 and 3-3 in TB MED 507, pages 13 and 14). Ensure adequate hydration of all soldiers prior to work or exercise. Monitor hydration by the color and volume of a soldier's urine. Remove barriers to drinking. Provide cool water if possible.
- 3) *Work-rest cycles/reduced heat exposure*: establish mandatory work-rest cycles. Plan heavy work/exercise in cooler morning or evening hours. Provide shade with good air circulation to reduce solar load.
- 4) *Clothing/equipment/supplies*: wear clean, appropriate uniforms to protect against sun, wind and other hazards. Use hats, head cloths, goggles and sunscreen as necessary. Change and wear dry socks.
- 5) *Weak link rule*: when the first heat casualty occurs, assess the status of the whole unit.

Protocol for Heat Stroke

Fort Bragg implementation: *Heat Stroke/Rhabdomyolysis* will be diagnosed when a patient, in the setting of heat exposure or exertion (documented elevated body temperature is not required), has any of the following (mental symptoms as reported by any witness or the patient):

- 1) Persistent (15 minutes or more) disorientation/confusion/combativeness.
- 2) Delirium or obtundation beyond the 3 minutes of a simple faint.
- 3) Coma—unresponsiveness beyond the 3 minutes of a simple faint.

1) Amnesia beyond 10-15 minutes immediately surrounding the event.

2) Labs elevated: CK>700, AST>60, ALT>60, LDH>400, creatinine>1.7 at 24-hours after the event, particularly if rising after initial values immediately following the event, or if associated with myoglobinuria (generally +blood on dipstick, without excessive red cells).

Per WAMC Clinical Guidelines 40-51, patients with Heat Stroke at Fort Bragg are given a P4(T) profile {on the PULHES system} upon discharge from the ER or Ward. {**NOTE**: it is recommended by COL John W. Gardner, MD, DrPH, that a patient should not be discharged from the hospital ward until their CK is <10,0400.} The patient is followed up at the Epidemiology and Disease Control (EDC) Clinic for further profiling and reporting through the Reportable Medical Events System (RMES) to the Army Medical Surveillance Activity. The patient is kept on quarters until his/her CK is <1000. Then they are put on a P3(T) profile x 3 months, which limits physical activity to 15-minutes a day, no parachute jumping, no wear of MOPP gear, no maximal exertion (e.g., cutting grass, ruckmarching, etc.), and no significant heat exposure (85°F or above for more than 15-minutes a day). The following statement is also included, "This service member cannot PCS to another duty station until the MEB for this Heat Stroke has been completed." This was added because so many soldiers with Heat Stroke have been PCS'd to duty stations where they had a recurrent heat injury, and were subsequently returned to Fort Bragg for their medical follow-up

A psychometric evaluation consultation and a nutrition evaluation consultation are entered into CHCS, and an MEB is scheduled to be done by the Chief, Department of Preventive Medicine, or his/her designated representative. {**NOTE**: heat stroke is one of the few medical conditions for an MEB to be done which does not require a permanent profile, per AR 40-501, Chapter 3-45.}

After 3 months on the above P3(T) profile, the patient is followed up. If the patient has not evidenced any adverse heat intolerance, or other physical/heat stress symptoms, they are put on a less restrictive P3(T) profile for 3 to 6 months. This is to allow the patient to gradually build up to the standards expected of soldiers. The second and less restrictive P3(T) profile continues to limit the patient from wearing MOPP gear, maximal exertion, exposure to heat above 85°F for more than 15-minutes a day, and no APFT 2-mile run; however, they are allowed to walk, swim or bicycle in place of the run. PT, ruckmarching, and running are allowed at patient's own pace and duration. Airborne

operations are limited to infrequent nontactical jumps for pay only.

When the patient is seen on the follow-up for the second P3(T) profile, they are assessed for any heat intolerance or heat/physical stress symptoms. If they are continuing to recover, they are then put on an even less stringent third P3(T) profile allowing full, unrestricted duty whose only restriction is no wear of MOPP gear through the next full hot season, i.e., 31 October of the year following the initial heat stroke. After this no wear of MOPP gear profile has been completed, and the patient has fully recovered, they are returned to full duty without restrictions. As can be seen, Heat Stroke patients require long-term recovery. AR 40-501, Chapter 3-45 states that "any evidence of significant heat intolerance, either during the period of the profile or subsequently, requires an addendum to the MEB and referral to a PEB."

Conclusion

A comprehensive hot weather injury prevention and management program should use the principles of Risk Management by identifying and assessing hazards in terms of severity and probability, and by implementing appropriate controls to abate those hazards. First-line leaders, and commanders, should supervise and spot-check to ensure control measures are being employed. Heat casualty prevention is a Command responsibility. Therefore, it is imperative that commanders and unit leaders are educated in the prevention of hot weather injuries using Risk Management principles with which they train their units.

Heat Stroke is a preventable medical emergency. This case report covered the main points in the diagnosis, treatment and prevention of Heat Stroke. The Fort Bragg implementation of Heat Stroke protocol was also presented as a model for others to use and/or modify at their discretion. The author welcomes any comments, and may be reached via e-mail at Robert.Oyler@na.amedd.army.mil, or telephonically at (910) 432-6925 or 9302 between 0730-1100 and 1230-1600 hrs., Monday thru Friday, except holidays.

Case Report: Community-Acquired Methicillin-Resistant Staphylococcus aureus (CA-MRSA) in Southwest Asia

By Nelson Sawyer, PA-C

Case Report

A 23 year old male mechanic presented to our battalion aid station(BAS) in western Iraq with a painful lesion on his post right forearm that had been present approximately 5 days. The patient denied any specific trauma to the site and did not

recall any insect or other animal bites.

His vital signs were normal and he was afebrile. He denied any significant past medical history and was not taking any medications at the time. Social history was positive for smoking 1 pack of cigarettes daily for 5 years, the patient denied alcohol or illicit drug use. A review of systems was negative for any systemic complaints. Physical examination revealed 3cm fluctuant lesion on the mid posterior right forearm with approximately 1cm of surrounding erythema. There was no epitrochlear, axillary or supraclavicular adenopathy, and the remainder of the physical examination was unremarkable.

The site was incised and drained (I&D) with a moderate amount of purulent discharge elicited. The site was packed with 1/4" Iodoform, dressed, and the patient was placed on Cephalexin 250mg four times daily x 10 days. I was unable to send a specimen for culture and sensitivity due to our remote location. The patient was followed in our aid station for daily dressing changes and the site healed without complications. Several weeks later the patient presented again to the aid station with 2 similar lesions approximately 1-1.5cm in diameter on the same extremity. The sites were I&D's with an 18 gauge needle, a wick placed, and the patient was started on Augmentin 875 BID with complete resolution in 10 days. The same patient returned to the BAS with similar lesions in the same location and it was decided to evacuate him to the Combat Support Hospital (CSH) for dermatological evaluation.

The patient returned with a diagnosis of Community Acquired Methicillin-Resistant Staphylococcus aureus(CA-MRSA). He was placed on Bactrim DS BID for 10 days and Mupirocin (Bactroban) Ointment to the nares and fingernails BID for 5 days with complete resolution of symptoms. He had one reoccurrence of symptoms approximately four weeks later which resolved with the same treatment regimen and no further reoccurrences.

Discussion

Staphylococcus aureus, commonly known as "Staph", are bacteria that commonly colonize the skin and anterior nostrils of 20-30% of healthy individuals. The first reported case of Methicillin-Resistant Staphylococcus aureus (MRSA) was reported in 1968.(1) Most providers are aware of Hospital Acquired MRSA (HA-MRSA) and its implications as an infectious pathogen. CA-MRSA was previously thought to be associated with outbreaks of HA-MRSA, but clinical and research data now indicate that CA MRSA is a uniquely distinct strain from HA-MRSA. There have been over 13,000 reported cases of CA-MRSA, with the majority of cases involving patients with no obvious risk factors.

(2) CA-MRSA is associated with a younger patient population than HA-MRSA (median age 23 years vs. 63 years).(3) In the pediatric population CA-MRSA is most frequently associated with underlying dermatological conditions. In the adult population the most common conditions reported were smoking, diabetes and dermatological conditions. There has been several outbreaks in correctional facilities, athletic teams, and the male homosexual population.(4) Most patients are young and healthy with a common association of sharing close quarters. Transmission of CA-MRSA is almost always by direct physical contact and not through airborne transmission. HA-MRSA requires treatment with either Vancomycin, linezolid (Zyvox), daptomycin (Cubicin) or quinupristin-dalfopristin (Synercid). CA-MRSA is a distinctly different pathogen and appears to be sensitive to minocycline, doxycycline, TMP/sulfamethoxazole (Bactrim, Septra) and clindamycin. The old adage that an abscess or boil is only healed with “cold steel” still applies, and incision and drainage are of paramount importance.(5) Whenever possible it is important to send off a specimen for culture and sensitivities.

Methods to prevent transmission of CA-MRSA include:

1. Do not share personal items (towels, soaps, etc)
2. Monitor, treat, and dress all open skin abrasions and cuts.
3. Always use Universal Precautions and good hand hygiene.

4. Chlorhexidine (Hibiclens) baths for extensive skin infection and to prevent recurrent outbreaks.

Greater than 90% of CA-MRSA is susceptible to TMP/sulfamethoxazole, tetracyclines or clindamycin. A ten day regimen of these antibiotics is recommended. Rifampin has excellent CA-MRSA coverage and the ability to penetrate the mucosal layer in high concentrations, but it must be used in combination therapy to prevent the rapid emergence of resistance. Rifampin in combination with other antibiotics has an excellent synergistic effect, and should be used for refractory or relapsing cases; but it should NEVER be used as monotherapy.(6) Treatments of choice are:

1. Minocycline 100mg PO BID x ten days
2. Doxycycline 100mg PO BID x ten days
3. Clindamycin 300-450mg PO QID x ten days
4. TMP/sulfamethoxazole DS 1 tablet BID x 10 days

Recurrent infections:

1. Add Rifampin to the above regimen 300-450mg BID x 5 days
2. Mupirocin (Bactroban) ointment in the nares and under the fingernails BID x 5 days.

This covers areas of colonization, and should also be

done to household and close contacts.

3. Shower with chlorhexadine (Hibiclens) daily x 3 days, repeat x 3 weeks.

4. Reserve Vancomycin, linezolid (Zyvox), daptomycin (Cubicin) and quinupristin-dalfopristin (Synercid) for severe cases.

Include Community-Acquired Methicillin-Resistant Staphylococcus aureus in your differential when treating an infectious skin lesion that is not responding to standard antibiotic treatment regimens.

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Condyloma Acuminata:

By Robert Oyler

Human Papilloma Virus (HPV) is a double-stranded DNA virus known to cause genital warts (condyloma acuminata), common warts (verrucae), and other epithelial proliferative lesions. HPV infects the epidermis of the skin, the mucosal membranes, and may cause cancer of the uterine cervix. More than 110 strains have been identified, some of which have cancer-producing potential. Ninety-two % of all cervical cancer has been associated with HPV. HPV, causing genital warts, has rapidly become the most

common viral cause of sexually transmitted disease (STD). In 2002, genital warts became the number one STD at Fort Bragg, eclipsing Chlamydia by 12.5%, per documentation at the Epidemiology and Disease Control (EDC) Clinic, of the Department of Preventive Medicine, Womack Army Medical Center. More than one million new cases are diagnosed in the United States each year, per Centers for Disease Control (CDC) statistics. It is estimated that one in three individuals are infected with HPV in the US. Infection with HPV is now three times more common than herpes simplex virus. HPV infection occurs at all ages; however, young, sexually active individuals are those most frequently infected. Recent studies done by the CDC estimate 25-40% of women under 25 years old are HPV infected; half of whom are positive for high-risk genotypes (cancer causing HPV). Infants may also be infected during childbirth. It is recommended women inform their Health Care Provider that they have HPV when getting a pap smear or during pregnancy. Genital warts may become so extensive in pregnancy that vaginal delivery is undesirable, although there is no evidence of vertical transmission of HPV. No serologic (blood) tests or cultures are available; therefore, HPV infection is noted primarily by clinical diagnosis. HPV lesions may appear flat, bumpy, or wart-like. They may be pink to skin-colored, or hyperpigmented (dark). The incubation period varies with each person; however, most people (approx. 80%) develop condyloma in 8 to 9 months. Some people may not have condyloma appear until years after they have been infected with HPV.

Infection includes 3 stages: subclinical, latent, and clinical. In the latent and subclinical stages, viral DNA is present in the skin and/or mucosa, but there are no warts present, and diagnosis is very difficult. From these 2 stages, HPV may become clinical and warts become visible, or remain dormant. Approx. 5% of HPV infected people are asymptomatic carriers. They have HPV but never have symptoms of it. Even though genital warts are an STD, transmission may occur through intimate contact without actual intercourse taking place. The actual percentage of infectivity is unknown, but is estimated by the CDC to be high when warts are present (approx. 90%) and low when they are absent (approx. 5%). Treatment of condyloma may be with liquid nitrogen (freezing), chemical products like Podophyllin, Condylox Solution or Aldara Cream, and electrocautery or laser surgery. Liquid nitrogen is extremely cold (-320 to -369 degrees F) and may cause blistering. Podophyllin has been shown to be mutagenic and may cause some condyloma to become cancerous. Condylox Solution is sometimes very irritating because it is in a 62% alcohol solution. Aldara Cream may also cause irritation, though not as much as Condylox Solution. Electrocautery and

laser surgeries occasionally result in scarring and are not fully successful in eliminating HPV. Estimates are approx. 70% at present for laser surgery to eliminate condyloma. This may also result in condyloma recurring next to, or in conjunction with, scarring from the laser surgery.

The CDC recommends everyone with condyloma should be screened for STDs. This includes gonorrhea, Chlamydia, syphilis, HIV, Hepatitis B and C, and also a urinalysis done for Trichomonas.

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National PA Week

Prior to reading an article in the October 2005 issue of JAAPA by Pamela Moyers Scott, MPAS, PA-C; included on a long list of things I didn't know was why, as a profession, we celebrate October 6. That is the date the first PA graduated from Duke University in 1967 and the birthday of Dr Eugene Stead, founder of the PA profession. I know this issue will not reach you prior to Oct 6 but I hope all of you managed to celebrated in appropriate fashion. Many thanks to all the "veteran" PAs who worked so hard to pave the way, in order that we all might enjoy the fruits of their labor. You know who you are. (CB)