HEAT STROKE IN OCTOBER

A Case Report

CAPT R N HAWORTH, MB, BS, DCH, RAMC
Dover/Shorncliffe Garrison

DR C S BALL, MB, BS, BSc
The William Harvey Hospital, Ashford

SUMMARY: A case of heat stroke in unusual circumstance, due to congenital ichthyosis and anhidrosis, is described, and some of the potential problems considered.

Case report

A slim 16-year-old caucasian army recruit with no significant past history collapsed at 1600 hours on an October afternoon, after running seven miles. The relative humidity was 99% and the air temperature 15.5°C (coastguard information). The Wet Bulb Globe Temperature Index was 15.36°C, not close to the point (31°C) at which restraint in normal training is recommended.

On examination 15 minutes later, he had an oral temperature of 41.5°C. His skin was dry, and he was not sweating. His pulse rate was greater than 150 per minute, blood pressure was 90 mmHg systolic, and he was hyperventilating. He was stripped, wrapped in a wet sheet, fanned, and ice packs applied. His temperature fell to 37.8°C over 30 minutes. During this time he remained delirious and his blood pressure fell to 70 mmHg systolic. His right side became flaccid and his eyes deviated to the left with dilated pupils which reacted sluggishly to light. He vomited twice. A slow intravenous infusion of Hartmann’s solution was established. During transfer to William Harvey Hospital, Ashford, he became fully conscious and experienced calf muscle cramps.

On admission, a systolic murmur was heard initially and his pulse rate remained 120 per minute for nine hours. There was some clumsiness of lower limb coordination. No other abnormalities apart from dry skin were found, and no renal failure ensued.

Biochemical investigations were performed and the results are illustrated in Table I. Additionally CXR, ECG, FBC, ESR, prothrombin time, alkaline phosphatase, thyroid function tests and MSU were normal. Creatinine clearance was 161 ml/min. The patient was transferred to Queen Elizabeth Military Hospital, Woolwich, for further investigation where his dry skin was again noted, with palmar hyperkeratoses and a family history recorded of a sister having dry skin. He was step tested along with a normal control with iodine starch applied to various parts of the body. The control changed all the powder to black but the patient failed to change the colour of the powder. It was thus shown that the patient was unable to sweat; a diagnosis of congenital ichthyosis and anhidrosis being made. This anomaly meant that it was dangerous for the patient to be involved in any excessive physical exertion. He was therefore medically downgraded as unfit for further military service.
Table I

Results of biochemical investigations

<table>
<thead>
<tr>
<th></th>
<th>Normal values</th>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
<th>Day 4</th>
<th>Day 5</th>
<th>Day 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>UREA mmol/l</td>
<td>2.5-6.6</td>
<td>9.4</td>
<td>8.3</td>
<td>6.2</td>
<td>5.5</td>
<td>4.9</td>
<td>5.1</td>
</tr>
<tr>
<td>Na+ mmol/l</td>
<td>141</td>
<td>137</td>
<td>138</td>
<td>136</td>
<td>140</td>
<td>135</td>
<td></td>
</tr>
<tr>
<td>K+ mmol/l</td>
<td>4.1</td>
<td>3.5</td>
<td>4.2</td>
<td>4.2</td>
<td>3.8</td>
<td>3.6</td>
<td></td>
</tr>
<tr>
<td>CPK iu/l</td>
<td>0-130</td>
<td>1186</td>
<td>678</td>
<td>286</td>
<td>75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AST iu/l</td>
<td>8-40</td>
<td>535</td>
<td>884</td>
<td>426</td>
<td>113</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LDH iu/l</td>
<td>25-175</td>
<td>679</td>
<td>657</td>
<td>443</td>
<td>279</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALT iu/l</td>
<td>5-75</td>
<td>445</td>
<td>1350</td>
<td>997</td>
<td>446</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Discussion

Several features of this case are unusual; the patient had not taken alcohol or drugs prior to the incident, had trained solely in the United Kingdom for nine months, and his illness occurred under normal training conditions. Heat stroke is caused by either increased heat production, or impaired heat dissipation. It is a rare disorder occurring mainly in the elderly, debilitated, and alcoholics, but is also common in military recruits undergoing the initial weeks of basic training.

Heat stroke must be distinguished from infections such as falciparum malaria; drugs such as atropine and amphetamines can cause heat stroke at low temperatures. Some skin diseases and the wearing of heavy clothing may prevent heat dissipation. Some patients with cardiovascular disorders are incapable of delivering the necessary quantity of blood for cooling.

There is a widespread metabolic disturbance within the body in heat stroke, some aspects of which were examined in this case. These changes include hyperventilation and respiratory alkalosis, possibly with lactic acidosis, hepatic impairment, striated and cardiac muscle damage, haematological disturbance following capillary endothelial damage which can lead to disseminated intravascular coagulation, cerebral problems, and particularly cerebellar damage which may be permanent.

The enzyme changes were typical of heat stroke. Despite the high values, the prognosis was good since the AST was less than 1,000 iu/l. Above this figure, permanent cerebral, renal, and hepatic damage is very common. Intravenous normal saline given slowly forms part of the treatment. Some authorities recommend mannitol as well. In retrospect, renal function should have been more closely monitored and a probable initial respiratory alkalosis, which can have serious consequences on cerebral blood flow, treated.

Conclusion

a. Although mild icthyosis may improve with time it should nevertheless be taken seriously in the Army.
b. Monitoring of enzyme levels is very useful and may help in diagnosis, and cerebellar damage should be specifically looked for after heat stroke has occurred.
c. During the early weeks of training, the absence of thermoregulatory problems resulting from ichthyosis do not preclude the occurrence of heat stroke subsequently.

Acknowledgements
The authors are grateful for the permission of Col I C Crawford L/RAMC and Capt J G Malone-Lee, RAMC to use their results from the Queen Elizabeth Military Hospital at Woolwich.

REFERENCES