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(*Accepted 2 June 1983*)

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Fatal heat stroke in a long distance runner

Death after marathon running has a long history.[1] Reports of fatal heat stroke appear regularly from other countries, particularly Australasia and North America, and documented cases have occurred in environmental temperatures as low as 10°C. We report the first case in this country and suggest measures for prevention and initial treatment.

Case report

A 29 year old man, experienced in marathon running, was admitted to hospital having collapsed after a 13 mile run in August 1982, when the temperature was 19°C, wind speed 6 knots, and humidity 30%. He had been taking antipyretics for a sore throat for one week, had a regular heavy alcohol intake, and had drunk six pints of beer the night before running. Relatives said that he had not drunk any fluids on the morning of the run and was behaving oddly five miles before the finish.

On admission to hospital he was unconscious and had peripheral cyanosis. His temperature was 40°C, pulse 140 beats/min, blood pressure 90/30 mm Hg, and central venous pressure −7 cm water. He was shivering and had dry, hot skin. Investigations yielded normal results apart from acidosis (pH 7·33, carbon dioxide partial pressure 4·8 kPa (36 mm Hg), oxygen partial pressure 9·8 kPa (74 mm Hg), bicarbonate 18 mmol(mEq)/l). He was treated with ice packs, saline infused initially at 1 l/hour, oxygen, dexamethasone, diazepam, and chlorpromazine.

Despite these measures his temperature did not fall below 38·5°C for six hours. A further two hours later oliguria developed, although central venous pressure was normal at 2 cm water after administration of three litres of saline. Sixteen hours after admission disseminated intravascular coagulation was diagnosed (thrombin time 26 s (normal 12 s) and concentrations of fibrinogen < 0·8 g/l and fibrin degradation products 16-32 μg/ml); this was treated with heparin 10 000 units every six hours, 4 units fresh frozen plasma, and 6 units platelets. His oliguria persisted, and after 40 hours he was transferred to the regional renal unit, where treatment with 300 mmol (25 g) sodium bicarbonate failed to correct his progressive acidosis. He was managed supportively, but 65 hours after the race, when the serum creatinine concentration was 780 μmol/l (8·8 mg/100 ml) and disseminated intravascular coagulation was still present, he developed fatal cardiac tamponade.

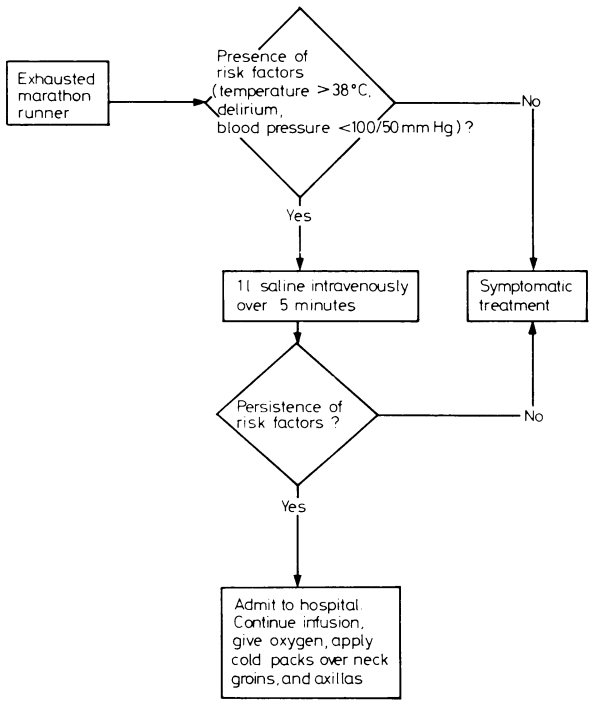
Postmortem examination showed widespread haemorrhagic disruption of skeletal and cardiac muscle. The kidneys showed acute tubular necrosis with pigment and granular casts. There was considerable fatty change in the liver, with degeneration and regeneration of hepatocytes.

Comment

Heat stroke has three diagnostic features—namely, rectal temperature >40°C, hot dry skin, and neurological signs, usually delirium, coma, and convulsions. The mortality, which averages 30%, is directly related to temperature. At high temperatures sweat glands fail to respond to acetylcholine and heat loss becomes inadequate despite increased skin blood flow. Liver and tissue damage lead to impaired haemostasis and occasionally to disseminated intravascular coagulation with fibrinolysis, and to reduced synthesis and metabolism of coagulation factors.[2] Acute renal failure, which occurs in 25% of cases, is caused by decreased renal blood flow, circulating pigments, and thermal damage.

In Britain hypothermia is more common than heat exhaustion in marathons.[3] Runners with either condition feel cold and shiver and are often supplied with space blankets. To prevent heat stroke races should be held at a suitable time and season. Competitors should be trained, acclimatised, and able to recognise early symptoms. They should know the risk factors and should not run if unwell.[4 5] Adequate hydration before, during, and after the race is essential, as this case report shows. Spotters should be deployed along the route to identify exhausted runners and emergency facilities provided to cool patients.

Rapid reduction of core temperature and maintenance of cardiac output are essential in the immediate management of heat exhaustion. As any delay may lead to fatal complications treatment should be started at once and on site. The figure shows a treatment protocol that needs minimal skill and equipment.



Flow chart for treating exhausted marathon runners.

We thank Dr J M Bone and Dr B D Linaker for allowing us to report on their patient and for their invaluable help and criticism.

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(*Accepted 27 May 1983*)

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