Marathon Problems

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Abstract

The medical challenges associated with long-distance and marathon running are discussed in the light of a recent long-distance run held in Malta. Management of problems associated with thermo-regulation and metabolic imbalance are discussed. Medical recommendations regarding the planning of such events are proposed to potential organisers.

Introduction

A long-distance run was organised by the Malta Olympic Committee on Saturday 20th June 1987 to commemorate Olympic Day. The starting point was at Saqqajja Hill, Rabat and the finishing point at St James Ditch, Valletta; a distance of 10km. The run started at 5 pm with an expected average running time of 55 minutes. 1,128 participants started the run at varying speeds. Just over 1,000 actually completed the course, the rest dropping out at various stages along the route. The maximum recorded ambient temperature for that day was 27°C, with a relative humidity of 60%. Two ambulances of the St John's Ambulance Brigade followed the athletes and were in communication with each other.

Towards the end of the run six participants collapsed; two were examined on the spot and quickly recovered, while four patients where transferred to the Casualty Department of St Luke's Hospital in various degrees of exhaustion. Two of these were examined, assessed and advised before being discharged some time later. Treatment consisted of oral fluid replacement by dextrose drinks. No significant musculoskeletal complaints were reported. Two persons had to be admitted because of the severity of their condition. Their case reports are presented below.

Case Reports

MG, a previously healthy 28-year old male bank employee, trained for long distance-running was admitted in an unconscious state. He had collapsed a few metres away from the finishing line. On examination he was not oriented to time, place or person, sweated profusely and vomited four times. He was breathing spontanously and his pupils reacted briskly to light. Examination showed a pulse rate of 120/min and a systolic blood pressure of 70mmHg; otherwise there were no abnormalities. Rapid intravenous fluid replacement raised the blood pressure to 130/85 mmHg. One hour after admission, he developed tetany which responded only after 20ml of 10% calcium gluconate were administered intravenously. Other relevent investigations were: Creatinine phosphokinase (CPK): 715 U/l, Hb: 14.8 g/dl, WBC: 21.8×10^9/1, Na^+: 142 mmol/l, K^+: 3.5 mmol/l, Cl^-; 110 mmol/l, Urea: 3.9 mmol/l. The blood sugar was 2.2 mmol/l. The estimated body core temperature was 38.4°C. Both the ECG and the chest X-ray (CXR) were normal Urinalysis showed glycosuria and proteinuria. The patient was cooled by means of a fan. The response to intravenous fluid and dextrose replacement was slow and the patient remained disorientated and restless for several hours.

MB, a previously healthy 30-year old male electrician, trained for short distance running was admitted in a conscious state. He collapsed about 250 metres away from the finishing line. He was not oriented to time but was oriented to place and person. He sweated profusely and vomited once. Examination showed a pulse rate of 150/min, blood pressure was 90/50 mmHg, otherwise there were no other abnormalities. Other relevant investigations included: CPK: 215 U/l, Na^+: 141 mmol/l, K^+: 4.7 mmol/l, Cl^-5: 97 mmol/l, Hb: 15.9 g/dl, WBC: 8.8×10^9/l. Blood sugar on admission was 2.2 mmol/l. Urinalysis showed both haematuria and glycosuria, while the ECG and CXR were normal. On admission the estimated body core temperature was 38.8°C. The patient's condition improved considerably after rapid intravenous fluid and dextrose replacement.

Both athletes were discharged from hospital in an excellent condition two days later. Neither of them had ever smoked and no drugs or alcohol were taken prior to or during the run.

Discussion

In both cases described above, heat exhaustion and dehydration were the principal features, clinically manifest by tachycardia, hypotension and disturbance of consciousness. Subsequent laboratory investigations showed elevated CPK levels, elevated white cell count, hypoglycaemia, haematuria and proteinuria. Long distance running also produces electrolyte disturbance and the ECG may suggest myocardial damage.

Hyperventilation was also a feature leading to respiratory alkalosis with clinical hypocalcaemia manifest by tetany. This may be superimposed on an underlying lactic acidosis secondary to anaerobic use of muscle glycogen.

The most serious medical problems encountered in long distance runs are those associated with thermoregulation. In short runs (10km or less), hyperthermia may occur even on relatively cold days and a very small change in body temperature (±2°C) may result in marked physical and mental impairement.

Body temperature rises with exercise and is dependent on processes producing heat and those facilitating heat loss. Production of heat increases in a direct relationship to running speed and in short races, heat production often outstrips loss. Heat loss during exercise depends on evaporation of sweat and when the relative humidity rises, heat loss is reduced. Therefore, the higher the relative humidity, the brighter the sun and the lesser the wind speed, the more is hyperthermia likely to occur.

Hyperthermia may be accompanied or preceded by heat exhaustion, heat syncope and heat stroke. The first signs are often a staggering gait, disordered thought and incoherent speech. These may be followed by sudden collapse and deep unconsciousness. The most serious complications related to heat stroke are disseminated intravascular clotting, acute renal failure and hepatic necrosis.

Hypothermia may occur in cold weather especially when the athlete slows down during the course of a long run. The early symptoms of hypothermia are speech difficulties and incoordinated movements; typically the runner tends to trip. Such symptoms may be aggravated following the run unless warm clothing and drinks are available.

Hypoglycaemia is also a recognised complication of long distance runs. Extreme muscular effort depletes muscle glycogen with consequent hypoglycaemia. Both cases reported above had a blood glucose level of 2.20 mmol/l on admission requiring prompt intravenous replacement by dextrose solution. Unless a blood sugar estimation is done, it may be difficult to identify hypoglycaemia as the symptoms are similar to those of hyperthermia or hypothermia.

Recommendations

Organisers of long distance runs have a responsibility to care for the health of the participants. Early in the planning stages of long-distance runs, expert medical advice should be sought in order to organise first-aid, making it available along the route in the form of adequately manned and equipped posts. If possible a handout giving basic *medical* instructions should be made available to participants beforehand and this should include advice about adequate training schedules and acclimatisation. The local hospital should be warned of the event. Athletes should not run even if mildly ill (e.g. respiratory tract or gastrointestinal tract infections).

The American College of Sports Medicine recommends that long distance runs of more than 16km should not be conducted in an ambient temperature of more than 28°C and this may mean having to reschedule the event for the early morning or the evening. Medical officers must have the right to pull out of the event competitors who exhibit warning signs of thermoregulatory derangement and dehydration.

The course itself should have as safe a surface as possible with no sharp projections, bollards or potholes. Drink stations are very important and should be placed at intervals of 3-4km. Water is the most important form of liquid replacement and glucose drinks should not be too concentrated.

First-aid stations should be sited 50-100 m down from the drinking stations and should have easy access to communication with an ambulance. A medical area having resuscitation facilities should be stationed at the finish line. The intense vasoconstroction maintaining the blood pressure in severely dehydrated runners may relax up to 20 minutes after finishing when there has not yet been time for adequate rehydration. Ambulances, camp beds, vomit bowls, plenty of water and ice together with dressings and intravenous rehydration facilities should be readily available.

Medical and first-aid officers should also expect to be confronted with a variety of musculoskeletal problems. They should be ready to deal with blisters, scrapes from falls, subungual haematomas, cramps, sprains, pulled muscles and fatigue fractures.

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