Public Health

Ultra-endurance exercise and hyponatremia

Epidemiology

Ultradistance athletic events such as marathon races and triathlons put participants at risk of exercise-induced hyponatremia (plasma sodium level < 130 [normally 135–146] mmol/L). As the popularity of these sports increases, so does the number of reports of exercise-associated hyponatremia.[1] The spectrum of symptoms attached to this condition may range from asymptomatic to mild symptoms of confusion and loss of coordination to life-threatening seizures, pulmonary edema and coma with increased intracranial pressure.

Some of the earliest recognized cases of exercise-induced hyponatremia occurred in 1981 in 2 runners participating in a 90-km race in South Africa.[2] Subsequent case reports involving participants in ultradistance athletics, including a series of 5 cases of hyponatremia reported during the 1985 Canadian Ironman Triathlon, contributed to the general perception that exercise-induced hyponatremia is a rare event associated with extraordinary physical effort. More recently, though, cases have been reported during shorter distance events, such as marathons, and this suggests that hyponatremia may be occurring more frequently than realized. According to one review article, the problem was identified in 9% of athletes who sought medical care after the 1996 New Zealand Ironman and in 29% of race finishers in the Hawaiian Ironman triathlon.[2]

The cause of the condition remains unclear. One proposal is that hyponatremia is caused by large, unreplaced salt losses in sweat-associated dehydration; others have noted the relation between low post-race plasma sodium concentrations and weight gain and have proposed that fluid overload is the cause. In 1998 Speedy and colleagues[3] measured the association between pre-race and post-race weight change and post-race plasma sodium concentrations in 605 athletes entered in the New Zealand Ironman triathlon. Of the 330 athletes who finished the race, 58 had a plasma sodium level of less than 135 mmol/L, but only 18 (31%) of them sought medical help. Of the 58 athletes 11 had hyponatremia: it was symptomatic in 7, and 8 had either maintained or gained weight over the race. The authors concluded that hyponatremia was a common biochemical finding in ultradistance athletes but was usually asymptomatic, and that fluid overload was the cause of most cases of severe, symptomatic hyponatremia in the athletes. It has been postulated that renal mechanisms fail to cope with this fluid because of either a decreased glomerular filtration rate during exercise or an inappropriately high arginine vasopressin level.

Clinical management

Hyponatremia can be associated with low, normal or high tonicity. Hypotonic (dilutional) hyponatremia represents an excess of water in relation to existing sodium stores. The manifestations of hypotonic hyponatremia are largely related to dysfunction of the central nervous system, and they are more conspicuous when the decrease in the plasma sodium concentration is large or rapid (occurring within a few hours). Headache, nausea, vomiting, muscle cramps, lethargy, disorientation and depressed reflexes can be observed. Complications of severe and rapidly evolving hyponatremia include seizures, coma, brain damage, respiratory arrest, brain-stem herniation and death.[4]

Severe cases of dilutional hyponatremia may be corrected by exogenous sodium, by letting the body diurese the excess free water while redistributing available sodium, or a combination of both.[5] The risks of overly rapid correction of hyponatremia and the development of pontine myelinolysis are well recognized. A recent review article on hyponatremia recommends a targeted rate of correction that does not exceed 8 mmol/L on any day of treatment. The authors provide a

helpful formula and table for determining the rate of infusion for selected infusates.[4]

Prevention

Ultra-endurance athletes should be made aware of the risks of overdrinking and hyponatremia as well as of the risks of dehydration. Restricting fluid intake to an appropriate volume, including some sodium-containing fluids, is advisable. Some authors recommend that weighing athletes before a race be a compulsory requirement of registration for these events and that post-race weights be included in the triage assessment of athletes presenting for medical care. They also recommend that an observation zone be added to the medical tent, that strict criteria for intravenous fluid administration be implemented and that support stations be placed at longer intervals throughout the event.[6] — *Erica Weir*, CMAJ

References

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