



GUIDANCE CONCERNING EXERTIONAL SYNDROMES FOR COMPETITORS, SUPPORT TEAMS AND PROFESSIONAL CARERS PARTICIPATING AND INVOLVED IN THE WEST HIGHLAND WAY RACE

Dr Chris Ellis, M Sc (Sports Med.), MFSEM
GP, Kinlochleven.
Race Doctor, West Highland Way Race.

INTRODUCTION

This guidance is written specifically for West Highland Way (WHW) Race athletes, support teams and carers to advise on avoidance, recognition and early management of some possible adverse consequences of extreme exertion, referred to collectively as “exertional syndromes”.

It discusses problems which have arisen in previous WHW or similar races. I have added acute compartment syndrome, which doesn't really belong in this category, but does, I feel warrant mention, because the consequences of failing to diagnose or suspect it at the first presentation are serious, and yet it is easily missed.

The rough terrain, disposing to lower limb injury, and the presentation of an ankle fracture, on which an athlete had been running for 75 miles, make me feel its mention is justified. For non-medical personnel, whom I envisage constitute much of the readership, some of what follows may be hard going.

I have deliberately started with discussion under headings of relevant conditions and tried to explain them in, what I hope, are understandable terms. After this, presentations are discussed more by symptoms, which is what happens in reality, more for the benefit of first aiders.

With the exception of collapse from post exertional low blood pressure, the conditions discussed cannot easily be treated by non-medical personnel, who do well to know of these conditions and suspect them. Treatment is left predominantly to the final section, destined for those doing the treating.

Nothing in this guidance is new, except application to the WHW Race. It comprises mainly findings and opinions from eminent authors who have studied similar events elsewhere, particularly South Africa. I appreciate the finishing times of the three events, Comrades Marathon (90km run), Two Oceans Marathon (56km run) and South African Ironman Triathlon (230km



GUIDANCE CONCERNING EXERTIONAL SYNDROMES FOR COMPETITORS, SUPPORT TEAMS AND PROFESSIONAL CARERS PARTICIPATING AND INVOLVED IN THE WEST HIGHLAND WAY RACE

swim/cycle/run), from which I draw most of my conclusions, are substantially shorter than the 15-35 hours of the WHW race, but think they have sufficient in common to make study findings from these events relevant.

That said, I hope, in time, to be able to base recommendations for the WHW race on study findings from it. To that end, I hope you will support me in future research.

I recommend athletes, supporters and carers keep these possibilities in mind in the event of becoming unwell.

Two conclusions I have come to over the last couple of years are, first, whatever the problem, athletes present with a limited number of symptoms, discussed later, and it may not be possible to decide, either on scene or in a clinical setting, whether an unwell athlete is seriously so or not, without performing blood tests.

Second, if an athlete is obviously unwell, the cause may not be obvious either, without blood tests. You should also consider that these presentations are rare, and some unheard of, outside endurance sport. Some of you may become unwell on arriving home and attend your local GP or A+E department. These professionals may reasonably be unfamiliar with the possible adverse consequences of your minority sport.

They too, may benefit from considering the contents of this guidance, which I suggest you take with you.

DISORDERS DISCUSSED

1) HYDRATION DISORDERS.

a) Dehydration, b) Over hydration/exercise associated low sodium/hyponatraemia (EAH).

2) MUSCLE BREAKDOWN/RHABDOMYOLYSIS

3) HEAT DISORDERS.

4) EXERCISE ASSOCIATED COLLAPSE (EAC)/POSTURAL HYPOTENSION (EAPH).

5) COMPARTMENT SYNDROME.

I assume that you are appropriately prepared, or preparing, for the race, are in good general health, have no long term medical conditions, and take no detrimental medications, such as anti-inflammatories, which promote fluid



GUIDANCE CONCERNING EXERTIONAL SYNDROMES FOR COMPETITORS, SUPPORT TEAMS AND PROFESSIONAL CARERS PARTICIPATING AND INVOLVED IN THE WEST HIGHLAND WAY RACE

retention, or drugs which impair heat loss (or, if you do, that appropriate advice has been sought).

You should have undertaken previous ultra marathons uneventfully, from the perspective of potentially recurrent, significant health consequences.

1) HYDRATION DISORDERS

The provision of categorical advice on optimal fluid replacement in the form of mls/hr is impossible. The best I can do is highlight some controversies and provide means of enabling you to make your own decisions.

First, over and underhydration are described, with severe consequences from both. Second, action taken through fear of one can cause the other.

This second issue has led to hospitalisation of some seriously ill runners from the WHW race in the last few years. In all cases, athletes drank excessively, possibly through fear of dehydration, and became fluid overloaded.

This caused waterlogging of vital organs, including lungs and brain, and dilution of the body's salts, including sodium, hence the name of the condition, exercise associated hyponatraemia (EAH).

To date, in the WHW race, no athlete has become unwell from dehydration. These findings, with the most seriously ill athletes being fluid overloaded tally with those reported from the other events listed.

This does not mean dehydration doesn't happen, but that the WHW race and events like it, are, for reasons discussed below, conducive to fluid overload. The three most important factors influencing heat production, and therefore sweat loss and need for fluids are body size, climatic conditions and intensity of exertion.

First, the bigger you are, the greater your heat production compared with a smaller counterpart doing the same work, and the more fluid you need. Second, the WHW race takes place in the Northern UK, over hilly terrain, and through two nights.



GUIDANCE CONCERNING EXERTIONAL SYNDROMES FOR COMPETITORS, SUPPORT TEAMS AND PROFESSIONAL CARERS PARTICIPATING AND INVOLVED IN THE WEST HIGHLAND WAY RACE

Third, the extreme length of the WHW race dictates that your intensity of effort, as a fraction of the maximum intensity of which you are capable, is low. Finishing times of 15-35 hours, indicating average speeds of 3-6 mph bear this out. In conclusion, heat generation through climatic and exercise intensity in the WHW race are relatively low, with sweat loss and fluid requirements to match. It is therefore easy to drink too much, particularly for slower runners. You do, of course, need to drink something guided as follows.

i) You can obtain an idea of your fluid needs from pre-race self-testing by measuring weight change (loss). Professor Douglas Casa describes how to do this in the web site.

<https://www.usatf.org/groups/Coaches/library/2007/hydration/USATFSelfTestingProgramForOptimalHydration.pdf>

He advocates weight change measurement over 1 hour's running. I contacted him suggesting that, in Scottish Highland weather, most scales wouldn't register a change over 1 hour, and proposed testing over 4-6 hours.

He agreed, pointing out the obvious need to measure any fluid (and food) intake, and fluid (and food!) output over the test period. I recommend you estimate your fluid losses during day and night, by self-testing over 4-6 hours.

It is important you run at race pace, and in race weather conditions. Use this to calculate your total estimated fluid loss for the race, based on estimated finishing time.

ii) While racing, I recommend monitoring your weight using scales capable of measuring small fluctuations (50-200g), which some electronic scales are. I have also recommended to race organisation that scales be added to the list of required items used by support teams at stipulated check-points.

Bear in mind, in undertaking this, you are measuring weight loss, which is NOT the same as sweat loss, because some of the weight loss is attributable to metabolism of fat and carbohydrate energy stores, which incidentally, frees up some water, which is used to meet part of your hydration requirements.



GUIDANCE CONCERNING EXERTIONAL SYNDROMES FOR COMPETITORS, SUPPORT TEAMS AND PROFESSIONAL CARERS PARTICIPATING AND INVOLVED IN THE WEST HIGHLAND WAY RACE

Invariably, when I speak to athletes about weight monitoring while racing, they think the prime reason is the detection of dehydration. Infact, for the reasons outlined above, for the WHW race, detection of weight gain, as a marker of fluid overload is the greater objective.

Controversy surrounds what you do about weight. Advice varies between recommending you maintain weight, to acceptance in (ultra-) marathons, of a small amount of weight loss (up to 2-4%). Water overload is much less likely if you lose 2-4%, which probably happens naturally, if you drink to thirst.

However, there is understandable concern about possible adverse effects of weight loss on well-being and performance. The findings from South Africa, in the settings previously discussed have not shown any adverse effects from this level of weight loss.

A cut-off point for acceptability, at 4% weight loss, appears cautious and arbitrary, but also sensible which I accept and will apply it in the WHW race as a possible indication for withdrawal. I therefore recommend that all athletes who gain weight, or who lose more than 4%, be reported to the race marshals, who should seek medical advice.

iii) I further recommend, on the basis of the literature evidence, and my interpretation of it, application of nature's guide to fluid replacement, thirst. We should not be surprised that nature allows some degree of fluid loss while exerting ourselves, before developing thirst. My impression is that, when drinking by thirst, 2-4% weight loss is normal, non-detrimental and hugely (but not totally) reduces the likelihood of EAH. I note the articles which describe these findings accept this state of affairs, identify its advantages, but hold back from recommending 2-4% weight loss directly, although do so indirectly by implying we do not aspire to weight maintenance.

iv) Finally, sources of guidance on fluid replacement are provided by the various authoritative bodies, including the International Marathon Medical Directors Association (IMMDA, 2006) which advocates a fluid intake during marathon running of 400-800mls/hr, and the American College of Sports Medicine, 600-1,200mls/hr



GUIDANCE CONCERNING EXERTIONAL SYNDROMES FOR COMPETITORS, SUPPORT TEAMS AND PROFESSIONAL CARERS PARTICIPATING AND INVOLVED IN THE WEST HIGHLAND WAY RACE

Based on the lesser intensity, through greater distance, of the WHW race, you should expect a fluid intake at or below the lower limits of these recommendations. You will note these recommendations, in keeping with much of the literature I have read, demonstrate a difference in opinion on fluid intake between South Africa and the United States, with the Americans generally advocating greater intakes, often advocating weight maintenance and drinking in excess of thirst, if necessary, to achieve that.

In drawing your own conclusions, it may help to know the fluid consumptions of the two most seriously ill athletes with EAH from the 2005 race were 500 and 600mls/hr, with sodiums 127 and 120mMol/l respectively (<130 = EAH). The limited evidence from the WHW race to date does not, in my opinion, support the American recommendations.

Unfortunately the symptoms and signs of over or under-hydration may be non-specific, as they tend to be of all the exertional syndromes. Weight gain may give clue of fluid overload, as may finger swelling, although I would not place much importance on the latter in isolation.

Behavioural and conscious level disturbance and seizures are features of EAH. If there is doubt, then measurement of blood sodium is needed, with serum sodium < 130mMol/l diagnostic of EAH. Ideally this should be done on location, but the limited resources of this small field, low budget race have not permitted this to date, although addressing this deficiency remains a personal priority.

Until such time, hospital remains the only place where blood tests can be undertaken. Less than 5% dehydration is also hard to detect clinically. The diagnosis is not aided by historical tendency to attribute a host of exertional ailments to dehydration (and heat), of which they may not be the cause at all, which makes it hard to know, just what, if any, are the symptoms of modest dehydration.

A history of inadequate fluid intake in a presenting athlete may be the only clue. Loss of skin elasticity and inhibition of salivation occur above 5% dehydration, making these signs not useful at lesser and usual presenting dehydration levels. Elevated blood sodium over 148mMol/l is diagnostic, with lesser degrees of elevation suggestive.



GUIDANCE CONCERNING EXERTIONAL SYNDROMES FOR COMPETITORS, SUPPORT TEAMS AND PROFESSIONAL CARERS PARTICIPATING AND INVOLVED IN THE WEST HIGHLAND WAY RACE

The type of fluid you take, whether water or appropriate electrolyte drink is much less important than the quantity. The IMMUDA, 2006, suggested “a mild blunting of sodium decline with sodium containing beverages”.

Thus, electrolyte drinks may diminish EAH but won't prevent it. The use of sodium containing drinks after running may assist restoration of plasma volume. If you are mixing your own electrolyte drink, be careful to ensure concentration of 25-30mMol/l.

If you don't understand or know how to do this, don't mix your own. If you are taking advice from friends, ask yourselves, “How and what do they know?” If you can't satisfy yourselves with answers to these questions, don't take their advice. Especially, avoid temptation to add extra sodium (salt) to your drink (or diet) to protect you against EAH, it won't.

Salt requirements are met from normal eating before, during and after the race. Therefore eat normally. Increased appetite for, and palatability of, salt are suggested following prolonged running, which, if applicable should be heeded. If this occurs at all, it is not universal, so don't be concerned if you don't experience it, just persevere with your usual, salt-containing diet.

2) MUSCLE BREAKDOWN/RHABDOMYOLYSIS

Four athletes have been hospitalised with this in the last 2 years. The muscles break down and liberate their contents into the circulation, with multiple consequences, including clogging of the kidneys, which then fail.

In keeping with the theme of this guidance, the manifestations of this are non-specific, although protracted vomiting was a feature in the 2 athletes most severely affected. Both these athletes had kidney failure, which may explain the vomiting, rather than the rhabdomyolysis itself, in which case, there are no obvious early features.

Muscle soreness may occur, but you can all expect this, without implicating rhabdomyolysis. 50% of athletes with rhabdomyolysis pass reddy-brown urine, discoloured by muscle breakdown products. As 50% do not, absence of discolouration is no reassurance.



GUIDANCE CONCERNING EXERTIONAL SYNDROMES FOR COMPETITORS, SUPPORT TEAMS AND PROFESSIONAL CARERS PARTICIPATING AND INVOLVED IN THE WEST HIGHLAND WAY RACE

Additionally, innocent blood stained urine can occur in runners merely by the bladder walls rubbing. Medical evaluation of discoloured urine is warranted. There appears no means of preventing this.

Exertion, heat, seizures and low sodium all dispose to it, but rhabdomyolysis can occur without any of these. There may be a hereditary disposition to rhabdomyolysis with suggested association between it, heatstroke and susceptibility to some drugs.

Muscle damage from the large (14,600 ft) amount of downhill running may also be a contributory factor, and a possible explanation for absence of similar cases in the South African studies reviewed.

3) HEAT DISORDERS/HEATSTROKE

Studies measuring rectal temperatures on South African Ironman triathletes, whether unwell or not, indicate frequent, but not universal, elevation with exertion. Elevation of temperature occurs in proportion to the metabolic rate, and also in proportion to any dehydration.

A spectrum of relatively minor disorders including muscle cramps, exhaustion and fainting also following exertion, has traditionally been attributed to heat and dehydration, without good evidence.

Many of these presentations may be more appropriately attributed to the postural fall in blood pressure following exertion, discussed below. I conclude that elevation of rectal temperature during exertion can and does occur, often normally, with levels not usually exceeding 39.5 degrees.

Many of these runners had no symptoms and were only detected because every competitor had his/her rectal temperature measured. In the absence of other symptoms, no action is required for temperatures up to 39.5 degrees.

Temperatures above 39.5 degrees were encountered, which, if associated with symptoms of lack of well-being, despite absence of good evidence that this lack of well-being was caused by the temperature, were actively lowered. The highest recorded temperature was 42 degrees. These athletes were therefore



GUIDANCE CONCERNING EXERTIONAL SYNDROMES FOR COMPETITORS, SUPPORT TEAMS AND PROFESSIONAL CARERS PARTICIPATING AND INVOLVED IN THE WEST HIGHLAND WAY RACE

“exertionally hot”, with or without other minor symptoms, which the heat may or may not have caused. An unrelated and undisputed phenomenon is the rare, life threatening “exertional heatstroke”.

The findings are elevation of rectal temperature over 40 degrees and mental impairment from overwhelming breakdown of bodily, including brain, function, manifest by muscle rigidity, confusion, seizures, coma and death (10-80% cases). “Exertional heatstroke” is usually distinguished from “classical heatstroke”. In the former, the underlying problem is an overproduction of heat. In the latter, the underlying problem is an inability to lose heat, which often affects the young and the old, most famously Mecca pilgrims.

No medical presentation from the WHW Race, has, to date, been attributed to exertional heat illness of any form. Again, should it, the presentation is non-specific with findings as above. Absence of sweating and persisting low blood pressure may be features of heatstroke, for which, prompt cooling is required, with urgent hospitalisation usually indicated. Genetic disposition to heatstroke is suggested, with association between it and malignant hyperpyrexia response to some drugs.

4) EXERCISE ASSOCIATED COLLAPSE (EAC) & EXERCISE ASSOCIATED POSTURAL HYPOTENSION (EAPH)

Exertional collapse can helpfully be differentiated according to whether it, or symptoms building up to it, arose before or after the finishing line. In the case of the WHW Race, the finishing line also means stage finishing line, if the athlete stops running.

Collapse while running is often serious, may be attributable to any cause of collapse, needs medical attention and probably hospitalisation. In contrast, 85% of those who cross the line well, but collapse very shortly after (seconds to small number of minutes) have innocent post-exertional low blood pressure, so named exercise associated postural hypotension (EAPH), which needs no treatment, other than to leave the runner lying with legs elevated, until symptoms pass, with drink and food as needed.



GUIDANCE CONCERNING EXERTIONAL SYNDROMES FOR COMPETITORS, SUPPORT TEAMS AND PROFESSIONAL CARERS PARTICIPATING AND INVOLVED IN THE WEST HIGHLAND WAY RACE

This leaves 15% of post exertional collapses, who do not have EAPH, who may have either a serious or minor, non-specific cause.

5) COMPARTMENT SYNDROME

Muscles which perform similar actions tend to lie next to one another and be enclosed jointly within a group covering of rigid sinew or fascia. Each group, or compartment, has its own blood vessels and nerve. Following injury, usually traumatic, but sometimes overuse, the muscles swell within the compartment.

The fascia is unyielding, so pressure rises and pain occurs. The rising pressure presses on the compartment's own blood supply making the bad situation worse. This process may occur in any group of enclosed muscles, but the lower leg is the commonest place.

Characteristics are:

- i) Trauma or overuse injury
- ii) Pain disproportionate to any recognised cause
- iii) Possible circumferential dressing or plaster
- iv) Severe pain on using or stretching affected muscles
- v) Sometimes pins and needles in leg or foot below.

BASIC FIRST AID FOR ATHLETES, SUPPORT TEAMS AND MARSHALS

1) Start the race feeling well, not if you are ill, feverish, hungover or have diarrhoea and vomiting. Anti-inflammatory medications such as ibuprofen (Brufen), diclofenac (Voltarol) and mefenamic acid (Ponstan) are fluid retaining and should be avoided before or during the race.

2) Start the race having done your homework. Be nourished and hydrated using a recognised and rehearsed regime. Document your starting weight. Know your estimated day and night hourly sweat losses following prior measurements in similar to race conditions. Take weight change measurements over a longer period than the hour advocated by Casa, using scales that measure small weight changes.



GUIDANCE CONCERNING EXERTIONAL SYNDROMES FOR COMPETITORS, SUPPORT TEAMS AND PROFESSIONAL CARERS PARTICIPATING AND INVOLVED IN THE WEST HIGHLAND WAY RACE

- 3) Drink by thirst. In doing so, you may lose 2-4% body weight during the race, without adverse consequences. Use your scales throughout to monitor weight. Seek medical advice if weight gained, or more than 4% lost.
- 4) If race day weather is unexpectedly hot, increase your fluid consumption, but still use thirst as your guide.
- 5) You can over or underhydrate whether you drink water or electrolyte drink. There may be slight advantages in using an appropriate electrolyte drink during and after the race.
- 6) Know the signs of something going wrong. Appreciate these signs are often non-specific which makes it difficult, without blood tests to know who is seriously ill and who has expected consequences of such a gruelling event. Also, if ill, it is hard to know why, again without blood tests.

Some of the symptoms which have arisen or may arise are listed and explained below.

Confusion

This is worrying and warrants withdrawal, although does not always have a serious cause. The athlete may not be aware of this, so there is onus on support teams and marshals to detect and act on it. Of the serious causes, heatstroke is possible, although this has not been seen in the WHW Race. EAH is more likely. Medical advice is warranted.

Seizures

As confusion, but more serious, since both fit and cause need to be dealt with. Urgent medical care/hospitalisation warranted.

Inordinate muscle pain (General/local)

Muscle pain is common and usually innocent. Through your training, you will know what is excessive. If excessive and generalised it may be due to rhabdomyolysis, or, if associated with mental impairment and rectal temperature above 40 degrees, to heatstroke. In either of these instances medical advice is warranted. Localised severe muscle pain, disproportionate to



GUIDANCE CONCERNING EXERTIONAL SYNDROMES FOR COMPETITORS, SUPPORT TEAMS AND PROFESSIONAL CARERS PARTICIPATING AND INVOLVED IN THE WEST HIGHLAND WAY RACE

any identified cause, usually in the calf, with or without injury, with or without circumferential dressing, may indicate compartment syndrome. If present, remove any dressing. If symptoms persist, medical advice is warranted.

Reddy-brown or bloody urine

This may indicate rhabdomyolysis which is serious or bladder wall rubbing, which is innocent. Whichever, seek medical advice and let the decision be made for you, possibly with blood and urine tests.

Vomiting

Vomiting is not normal, although not always serious. Two cases of rhabdomyolysis, with associated acute renal failure, seen in 2005 and 2007 vomited for many hours after race completion, before seeking medical help. One started vomiting during the last mile. Gastroenteritis and heatstroke may also cause vomiting. Sometimes the cause is non-specific. Persistent vomiting during or after the race warrants medical advice.

Collapse

The likely cause is governed by timing, as discussed under EAC/EAPH. Collapse while running and well after finishing are abnormal and warrant medical attention. Collapse just after finishing, if well on finishing, is probably innocent and can be treated on scene by lying with feet elevated, drinking and eating. Failure to restore well-being within 20 minutes warrants medical attention. Causes of collapse may be non-exertional (cardiac arrest, myocardial infarction, sub-arachnoid haemorrhage, diabetic coma, gastroenteritis, hypothermia, bowel infarction) or exertional (EAPH, hypoglycaemia, EAH, heatstroke). .

FIRST AID FOR PROFESSIONAL PRIMARY CARERS TREATING ATHLETES FROM WHW RACE

Following diagnosis and early management of many of the conditions discussed, specialist secondary care will be needed. The nature of such secondary care goes beyond my experience, and the scope of this leaflet. My goals are to promote suspicion, confirmation (or exclusion) and early management of these



GUIDANCE CONCERNING EXERTIONAL SYNDROMES FOR COMPETITORS, SUPPORT TEAMS AND PROFESSIONAL CARERS PARTICIPATING AND INVOLVED IN THE WEST HIGHLAND WAY RACE

disorders, with appropriate transfer to secondary care for definitive management.

The process starts with an awareness of what might be going on. If you have read this leaflet, most possibilities are covered. As always, history is next. In addition to your usual history ask specifically about collapse, confusion, seizures, vomiting, urine discoloration.

Establish some simple facts about the race. What were the weather conditions? How far and for how long had the athlete been running? From this you can establish intensity of effort. How much, and of what had the athlete drunk? What were the weight changes? Are the fingers swollen/rings tight? Was the athlete well beforehand? Is the athlete taking any fluid retaining (NSAIDs) or heat loss impairing medications?

If the athlete collapsed, establish the circumstances. Did the athlete cross the finishing line relatively well and collapse immediately after or not? If the athlete collapsed while running or some time after finishing, you probably have a serious medical problem on your hands, which may or may not be exercise specific, and you need to consider all causes of collapse.

If the athlete crossed the line well, then collapsed very soon after, and looks well, EAPH is likely with no invasive action needed. First aiders can manage this on scene, by leaving the athlete lying with feet elevated, encouraging to eat and drink and expectation of recovery within 20 minutes, and referral for medical assessment if not.

In addition to usual examination, measure rectal temperature, erect and supine blood pressures, weight and inspect and test urine. Bloody looking urine may be completely innocent from bladder wall running trauma, or may be due to myoglobin from rhabdomyolysis. Clinical assessment for over and underhydration, including for peripheral oedema/finger swelling and mouth dryness, is unreliable.



GUIDANCE CONCERNING EXERTIONAL SYNDROMES FOR COMPETITORS, SUPPORT TEAMS AND PROFESSIONAL CARERS PARTICIPATING AND INVOLVED IN THE WEST HIGHLAND WAY RACE

Any investigations should include blood glucose, electrolytes and creatinine kinase. In interpreting investigations consider the extension of normal range following profound exertion whereby creatinine kinase (CK), may be 3-5 times resting normal, and aspartate transaminase (AST), lactate dehydrogenase (LDH), bilirubin and troponin T all exertionally elevated.

Resist the temptation to label every poorly athlete as “heat exhaustion” or “dehydration”. Consideration of the circumstances will help. If your casualty just won the local half marathon, barely stopping to drink, on a roasting day, and became weak, dizzy and nauseous twenty minutes after the race, he is probably hot and dry, (although may have other problems too). After attending to A and B, consider rapid iv infusion, pending diagnostic blood results, with sodium above 148 indicative of significant dehydration.

If the rectal temperature is raised above 39.5 degrees, cool him by either immersional (partial or complete) or evaporative means, according to departmental protocol and practical restrictions of prior ABC management.

In the unlikely event of rectal temperature exceeding 40 degrees and in the presence of neurological deficit, he has heatstroke, which is life-threatening, warrants rapid cooling as above, and, should the condition not improve after 5-10 minutes of cooling, involve the most senior help available, to address the likely associated deterioration from multi-organ failure.

In contrast, a confused WHW Race runner, who finished in 35 hours, having run slowly through two chilly Highland nights, who filled his camel-back with two litres of water at eight refreshment stops and whose back up team report has gained weight, probably has EAH.

It would be sensible to wait for the blood electrolytes rather than add unnecessarily and dangerously to his fluid overload. On confirming low sodium, governed by level and symptoms, implement fluid restriction, and prepare to administer 3% saline +/- diuretics following discussion with appropriate senior, observing the EAH consensus recommendations listed for further reading at the end of this guideline. Rhabdomyolysis and exertional hypoglycaemia will be obvious following clinical suspicion and routine CK and blood glucose measurement. Low sugar is easily corrected.



GUIDANCE CONCERNING EXERTIONAL SYNDROMES FOR COMPETITORS, SUPPORT TEAMS AND PROFESSIONAL CARERS PARTICIPATING AND INVOLVED IN THE WEST HIGHLAND WAY RACE

Severe EAH and rhabdomyolysis require involvement of a kidney specialist. Even more problematic is the occurrence of the two phenomena together as happened twice during the 2005 WHW Race. The message here is that more than one of these conditions can happen in the same athlete.

CLOSURE and WHAT NEXT?

This completes the first medical guidance leaflet for WHW Race runners. I hope it is informative. Although, preferably, no more of you encounter the problems discussed, this is unlikely. At best, hydration disorders, particularly EAH will be reduced, and this and other conditions recognised and treated sooner.

My expectation is that this will be an evolving document where athletes can ask questions and academics can highlight errors and controversies. I already have in mind some areas for further work, including production of some self-test data on weight changes from local athletes, providing some nutritional guidance, pursuit of on scene blood electrolyte measurement facility* and investigation of recent improvements in tracking technology.

The staff at Kinlochleven surgery are committed to your race, and enjoy hosting you on our premises. We hope your preparation and race go uneventfully, but we, and our colleagues in hospital, paramedic and mountain rescue services in Lochaber are there if you need us.

*The obtaining of this equipment is prevented only by funding. Each unit is £5,000. Any suggestions or contributions welcome.

ACKNOWLEDGEMENTS

I am privileged and grateful, in writing this, to have read guiding books and papers by distinguished authors, who have also answered questions. These authors, listed below, are however, in no way responsible for the content of this guideline, which is exclusively my adaptation of their findings and recommendations, for WHW Race purposes.



**GUIDANCE CONCERNING EXERTIONAL SYNDROMES
FOR COMPETITORS, SUPPORT TEAMS AND
PROFESSIONAL CARERS PARTICIPATING AND
INVOLVED IN THE WEST HIGHLAND WAY RACE**

Professor Douglas Casa, University of Connecticut, USA

Dr Tamara Hew-Butler, University of Cape Town, South Africa

Professor Timothy Noakes, University of Cape Town, South Africa.

I also appreciate the assistance of clinical colleagues in caring for injured athletes and granting me access to records.

Dr Brian Tregaskis, Physician, Fort William hospital

Dr Shahid Barlas, Physician, Fort William hospital

Dr Margaret McMillan, Physician, Western Infirmary, Glasgow

The Staff, Kinlochleven Medical Practice.

Finally, I'm grateful to all the athletes who have allowed details of their mishaps to be used for the benefit of others.



GUIDANCE CONCERNING EXERTIONAL SYNDROMES FOR COMPETITORS, SUPPORT TEAMS AND PROFESSIONAL CARERS PARTICIPATING AND INVOLVED IN THE WEST HIGHLAND WAY RACE

FURTHER READING

BOOKS

Noakes T (2003) Lore of Running. Human Kinetics.

ACADEMIC PAPERS

Hew-Butler T. et al (2005). Consensus Statement of the 1st International Exercise-Associated

Hyponatraemia Consensus Development Conference, Cape Town, South Africa 2005. Clinical J. Sp. Med. 15(4): 206-211.

Hew-Butler T. et al (2006). Updated Fluid Recommendation: Position Statement From the International Marathon Medical Directors Association (IMMDA). Clinical J. Sp. Med. 16(4): 283-292.

Sharwood K. et al (2004). Weight changes, medical complications, and performance during an Ironman triathlon.

British J. Sp. Med. 38(6): 718-724

Holtzhausen L. et al (1994). Clinical and biochemical characteristics of collapsed ultramarathon runners.

Medicine and Science in Sp. and Ex. 26(9): 1095-1101

Holtzhausen L. et al (1997). Collapsed Ultraendurance Athlete: Proposed Mechanisms and Approach to Management.

Clinical J. Sp. Med. 7(4): 292-301.