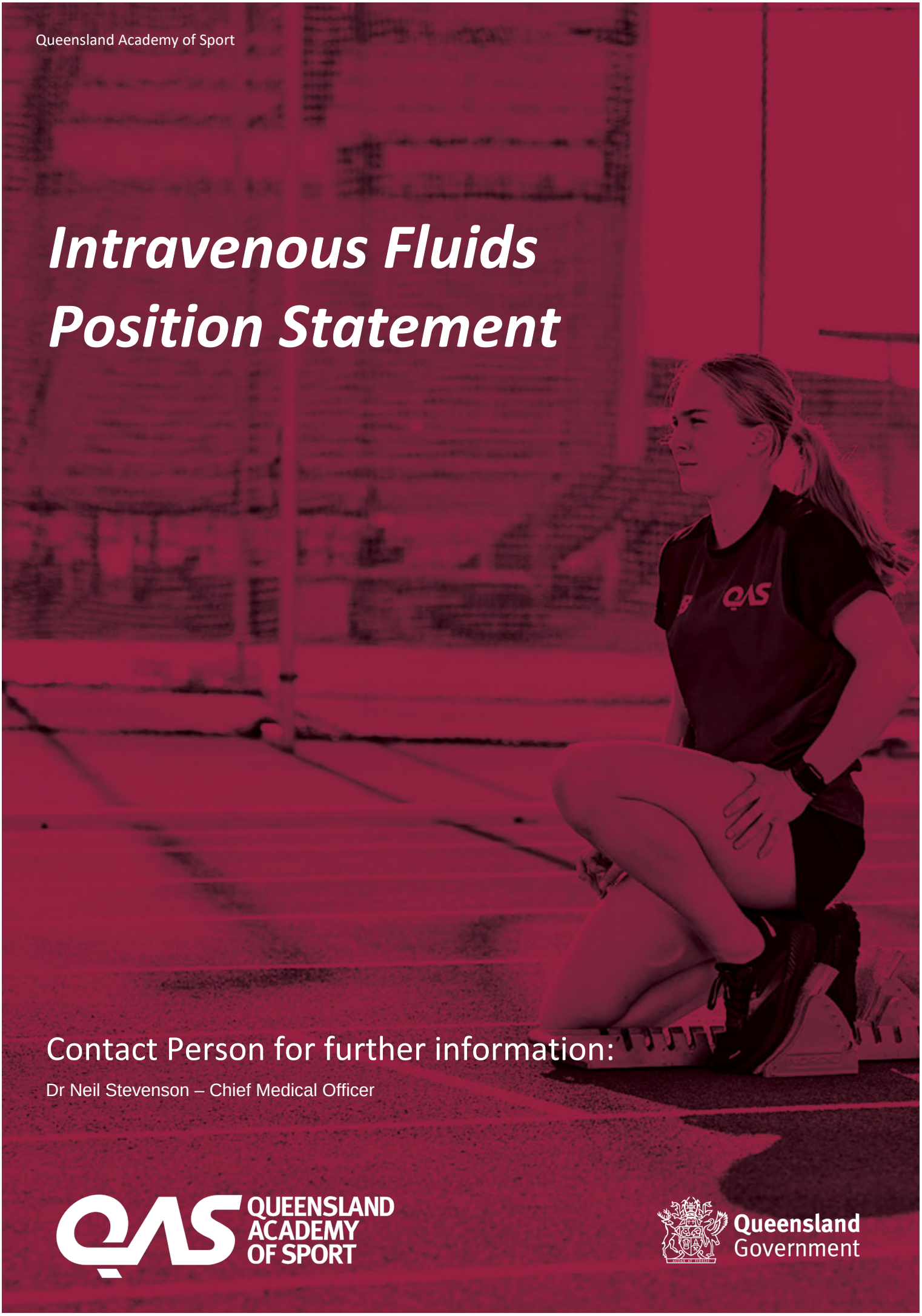
Queensland Academy of Sport

Intravenous Fluids Position Statement



Contact Person for further information:

Dr Neil Stevenson – Chief Medical Officer

QUEENSLAND ACADEMY OF SPORT

Queensland Government

Intravenous Fluids Position Statement

Revision History

Version	Reviewed by	Changes made
1.0	QAS Chief Medical Officer – Dr Sharon Stay Original Acknowledgement Dr Sam Pomroy Dr Greg Lovell Dr David Hughes Dr Nicole Vlahovich Australian Institute of Sport (AIS) October 2019	
2.0	November 2024 QAS Chief Medical Officer – Dr Neil Stevenson	Reviewed by: QAS Chief Medical Officer – Dr Neil Stevenson No amendments made.

INTRAVENOUS FLUIDS AND THEIR USE IN SPORT: A POSITION STATEMENT FROM THE AUSTRALIAN INSTITUTE OF SPORT

Dr Sam Pomroy, Dr Greg Lovell, Dr David Hughes, Dr Nicole Vlahovich
Australian Institute of Sport

DOI: https://doi.org/doi:10.1016/j.jsams.2019.10.020

Reference: JSAMS 2191

To appear in: Journal of Science and Medicine in Sport

Received Date: 22 July 2019
Revised Date: 22 October 2019
Accepted Date: 26 October 2019

Intravenous (IV) fluid prescription in medicine mainly occurs within a hospital setting. The use, timing, type and volume of IV fluids, outside of a hospital setting has, however, evolved over recent decades. Changes have occurred because of the lessons learnt in operational requirements of military and emergency response teams. Medical practitioners working within the elite sporting environment are required to give consideration to the World Anti-Doping Code (WADC) which places limitations on the location, indications and rate of delivery of IV fluids and infusions.[1] Therapeutic Use Exemptions (TUE) can be granted for use of IV fluids with appropriate clinical justification.[1,2] There is little information in the medical literature to inform clinicians in the elite sport environment about the appropriate indications for IV fluid use in balancing the medical care of the athlete against the restrictions stipulated in the WADC. This position statement seeks to assist clinicians by providing evidence-based and ethically justified guidelines for the use of IV fluids in emergency situations in elite sport.

1. Physicians must be aware that IV fluid administration is not without risk or harm. There are potential adverse effects from IV fluid administration, including;
   - Complications at the injection site (infection, phlebitis and venous thrombosis)
   - Fluid and solute overload resulting in electrolyte abnormalities
   - Over-hydration
   - Congestive conditions (central and peripheral)
   - Acid base imbalances
   - Financial cost to administer IV fluids, which includes appropriate staffing and monitoring

2. Recommendations for the treatment of severe dehydration include;
   - Monitor clinical signs and symptoms (see Table 2) and consider measurement of plasma sodium and blood glucose
   - If IV rehydration is indicated, 10-20 mL/kg bolus of 0.9% sodium chloride initially and consider repeating these boluses until adequate haemodynamics are restored
   - Where severe exercise-associated hyponatremia (EAH) is present, manifesting in neurological impairment and inability to tolerate oral hypertonic salt broth, treat with IV hypertonic saline bolus of 100ml 3% Normal Saline, once low serum sodium levels are confirmed.
   - A TUE is required if IV fluids are used >100 mL/12 hours, outside of approved settings

Table 1: Clinical signs of dehydration

Symptom	Mild	Moderate	Severe
% wt. loss	3-5%	6-9%	>10%
Pulse	Full, normal rate	Rapid, thready	Very rapid and weak or absent
Respiration	Normal	Deep, may be increased	Deep, rapid or decreased
Systolic blood pressure	Normal	Normal to low	Low
Buccal mucosa	Normal	Dry	Parched
Eyes	Normal	Sunken	Markedly sunken
Skin turgor	Normal	Reduced	Tenting
Skin	Normal	Cool	Cool, mottled
Urine output	Decreased	Oliguria	Oliguria to anuria
Systemic signs	Increased thirst, alert	Listless, irritable	Lethargic, coma
Capillary refill	2 sec	2-4 sec	>4 sec, cool limbs

3. Recommendations for the treatment of heat syncope include;
   - Encourage oral fluids
   - IV fluids are not indicated for the management of heat syncope and therefore no TUE is required
   - If there is a failure to improve after 15-20 minutes, transfer to a medical facility for further investigation

Table 2: Simple strategies for the treatment of heat syncope

Move to shaded, cool area
Lay supine with feet elevated above head
Oral fluids once mentally alert
Fanning the athlete
Wet ice towels
Water spray
Remove excess clothing and equipment

4. Recommendations for the treatment of heat exhaustion include;
   - Associated with a core body temperature of elevated to 38.3-40°C
   - IV fluids should be considered in the setting of deteriorating mental status or persistent nausea or vomiting
   - If there is no rapid improvement following cooling strategies transfer immediately to hospital to exclude heat stroke
   - A TUE is required if IV fluids are used >100 mL/12 hours, outside of approved settings

5. Recommendations for the treatment of exertional heat stroke (EHS) include;
   - Affects multiple body systems in association with high core temperatures (> 40-40.5°C)
   - Aim to cool the patient first and transport second if appropriate medical staff and cooling strategies are present
   - IV hydration can be considered for circulatory support in EHS, however small boluses should be given
   - A TUE is required if IV fluids are used >100 mL/12 hours, outside of approved settings

6. Recommendations for the treatment of trauma in sport include;
   - When there is loss of the radial pulse (or central pulse in penetrating torso trauma), IV crystalloid boluses of 250 mL are recommended
   - Boluses are titrated to maintenance of a pulse
   - If a significant head injury exists, consider larger volumes to maintain cerebral perfusion pressure
   - Priority is to transport the patient to a trauma centre as soon as possible
   - A TUE is required if IV fluids are used >100 mL/12 hours, outside of approved settings

7. Recommendations for administration of medication by IV include;
   - Only utilised when there is a clear clinical indication for use of that medication
   - The IV medication should be checked against the WADA Prohibited List as it may require a TUE
   - If not prohibited but the volume of fluid required to deliver the medication is >100 mL in 12 hours, then a TUE is required where administration takes place outside of approved settings

This AIS position statement provides recommendations for physicians working in the elite sporting environment when considering use of intravenous fluids in adherence with the WADC guidelines. The current literature supports appropriate use of intravenous fluids to protect the health of athletes in specific clinical situations. Prioritising athlete health aligns with the WADC. Clinical scenarios within elite sport that warrant use of intravenous fluids include severe dehydration, exertional heat illness, trauma and administration of medications.

REFERENCES

1. World Anti-Doping Code 2015 with 2019 amendments. 2019. [Accessed June, 2019, at https://www.wada-ama.org/sites/default/files/resources/files/wada_anti-doping_code_2019_english_final_revised_v1_linked.pdf.]
2. International standard for therapeutic use exemptions. 2019. [Accessed June, 2019, at https://www.wada-ama.org/sites/default/files/resources/files/istue_2019_en_new.pdf.]
3. Prohibited List. 2019. [Accessed June, 2019, at https://www.wada-ama.org/sites/default/files/wada_2019_english_prohibited_list.pdf.]
4. Anti-Doping Important Facts and Highlights from WADA's Athlete Guide. 2015. [Accessed June, 2019, at https://www.wada-ama.org/sites/default/files/wada_anti-doping_aag_eng_web.pdf.]
5. TUE Physician Guidelines Medical Information to Support the Decisions of TUECs Intravenous Infusions. 2018. [Accessed June, 2019, at https://www.wada-ama.org/sites/default/files/resources/files/intravenous_infusions_v5.0_jan2018_en.pdf.]
6. Coombes JS, van Rosendal SP. Use of intravenous rehydration in the National Football League. LWW; 2011.
7. Athlete Biological Passport. 2018. [Accessed November, 2018, at https://www.wada-ama.org/en/athlete-biological-passport.]
8. Therapeutic Use Exemption (TUE). 2018. [Accessed January, 2019 at https://www.wada-ama.org/en/questions-answers/therapeutic-use-exemption-tue#item-730.]
9. TUEC Guidelines Medical Information to Support the Decisions of TUE Committees Intravenous Infusions. 2018. [Accessed November 2018, at https://www.wada-ama.org/sites/default/files/resources/files/tue_intravenousinfusions_version5.1_july2018.pdf.]
10. Revell M, Porter K, Greaves I. Fluid resuscitation in prehospital trauma care: a consensus view. Emergency Medicine Journal 2002;19:494-8.
11. National Institute for Clinical Excellence. Prehospital initiation of fluid replacement therapy in trauma: Technology appraisal guidance 74: London: NHS Publishers; 2004.
12. Cotton BA, Jerome R, Collier BR, et al. Guidelines for prehospital fluid resuscitation in the injured patient. Journal of Trauma and Acute Care Surgery 2009;67:389-402.
13. Casa DJ, Ganio MS, Lopez RM, McDermott BP, Armstrong LE, Maresh CM. Intravenous versus oral rehydration: physiological, performance, and legal considerations. Current Sports Medicine Reports 2008;7:S41-S9.
14. Summary of IV fluids composition (mmol/L). 2012. 2018, [Accessed January 2019 at http://www.frca.co.uk/article.aspx?articleid=295#.]
15. Casa DJ, Maresh CM, Armstrong LE, et al. Intravenous versus oral rehydration during a brief period: responses to subsequent exercise in the heat. Medicine and science in sports and exercise 2000;32:124-33.
16. Huang LH, Lennox H. Dehydration. Medscape Reference 2009.
17. Cheuvront SN, Sawka MN. Hydration assessment of athletes. Sports Sci Exchange 2005;18:1-6.
18. Steiner MJ, DeWalt DA, Byerley JS. Is this child dehydrated? JAMA 2004;291:2746-54.
19. Gorelick MH, Shaw KN, Murphy KO. Validity and reliability of clinical signs in the diagnosis of dehydration in children. Pediatrics 1997;99:e6-e.
20. McGee S, Abernethy III WB, Simel DL. Is this patient hypovolemic? JAMA 1999;281:1022-9.
21. Thomas DR, Tariq SH, Makhdomm S, Haddad R, Moinuddin A. Physician misdiagnosis of dehydration in older adults. Journal of the American Medical Directors Association 2003;4:251-4.

22. Noakes T. Fluid and electrolyte disturbances in heat illness. International journal of sports medicine 1998;19:S146-S9.

23. Vesikari T, Isolauri E, Baer M. A comparative trial of rapid oral and intravenous rehydration in acute diarrhoea. Acta Pædiatrica 1987;76:300-5.

24. Freedman SB, Ali S, Oleszczuk M, Gouin S, Hartling L. Treatment of acute gastroenteritis in children: an overview of systematic reviews of interventions commonly used in developed countries. Evidence- Based Child Health: A Cochrane Review Journal 2013;8:1123-37.

25. Stanton BF, Rowland M, Clemens J. Oral rehydration solution--too little or too much? Lancet (London, England) 1987;1:33.

26. Spital A. Dehydration versus Volume Depletion—and the Importance of Getting it Right. American Journal of Kidney Diseases 2007;49:721-2.

27. Maresh CM, Herrera-Soto JA, Armstrong LE, et al. Perceptual responses in the heat after brief intravenous versus oral rehydration. Medicine and science in sports and exercise 2001;33:1039-45.

28. O'Connor FG, Casa D. Exertional heat illness in adolescents and adults: Management and prevention. UpToDate 2015.

29. Hew-Butler T, Ayus JC, Kipps C, et al. Statement of the second international exercise-associated hyponatremia consensus development conference, New Zealand, 2007. Clinical Journal of Sport Medicine 2008;18:111-21.

30. Supportive management of acute gastroenteritis. 2018. (Accessed January 2019 at https://tgldcdp.tg.org.au/viewTopic?topicfile=supportive-management-gastrointestinal&guidelineName=Gastrointestinal#toc_d1e453.)

31. Hew-Butler T, Rosner MH, Fowkes-Godek S, et al. Statement of the third international exercise-associated hyponatremia consensus development conference, Carlsbad, California, 2015. Clinical Journal of Sport Medicine 2015; 303-320.

32. Freedman S. Oral rehydration therapy. UpToDate 2017.

33. Maron BJ, Doerer JJ, Haas TS, Tierney DM, Mueller FO. Sudden deaths in young competitive athletes: analysis of 1866 deaths in the United States, 1980–2006. Circulation 2009;119:1085-92.

34. Kucera K, Yau R, Cox Thomas L, Wolff C, Cantu R. Catastrophic sports injury research—thirty second annual report. 2015.

35. Kucera K, Klossner D, Colgate B, Cantu R. Annual survey of football injury research: 1931-2018. Chapel Hill, NC: National Center for Catastrophic Sport Injury Research at the University of North Carolina at Chapel Hill for the American Footbal Coaches Association, National Collegiate Athletic Association, & National Federal of State High School Associations: National Center for Catastrophic Sport Injury Research at the University of North Carolina at Chapel Hill 2019.

36. Australian Resuscitation Council. The ARC guidelines. 2016.

37. Monsieurs KG, Nolan JP, Bossaert LL, et al. European resuscitation council guidelines for resuscitation 2015 section 1. Executive summary. Resuscitation-Limerick, 1972, currens 2015;95:1-80.

38. Medical Protocols for Match Day Medical Staff. 2018. (Accessed October 2018, at http://playerwelfare.worldrugby.org/?documentid=module&module=23.)

39. Centers for Disease Control Prevention, National Center for Health Statistics. International classification of diseases, clinical modification (ICD-9-CM). Hyattsville: National Center for Health Statistics; 2008.

40. Murrell C, Wilson L, Cotter JD, et al. Alterations in autonomic function and cerebral hemodynamics to orthostatic challenge following a mountain marathon. Journal of applied physiology 2007;103:88-96.

41. O'Connor FG, Casa D. Exertional heat illness in adolescents and adults: Epidemiology, thermoregulation, risk factors, and diagnosis. UpToDate, Waltham, MA. (Accessed on October 2018)

42. Crandall CG. Heat stress and baroreflex regulation of blood pressure. Medicine and science in sports and exercise 2008;40:2063.

43. Charkoudian N, Halliwill JR, Morgan BJ, Eisenach JH, Joyner MJ. Influences of hydration on post- exercise cardiovascular control in humans. The Journal of Physiology 2003;552:635-44.

44. Cheuvront SN, Kenefick RW, Montain SJ, Sawka MN. Mechanisms of aerobic performance impairment with heat stress and dehydration. Journal of Applied Physiology 2010;109:1989-95.

45. Wilson TE, Cui J, Zhang R, Crandall CG. Heat stress reduces cerebral blood velocity and markedly impairs orthostatic tolerance in humans. American Journal of Physiology-Regulatory, Integrative and Comparative Physiology 2006;291:R1443-R8.

46. Asplund CA, O'Connor FG, Noakes TD. Exercise-associated collapse: an evidence-based review and primer for clinicians. British Journal Sports Medicine 2011:bjsports-2011-090378.

47. Therapeutic Guidelines Ltd. Heat-related illness. 2018 [Accessed June 2019 at https://tgldcdp.tg.org.au/viewTopic?topicfile=heat-related-illness .

48. Moore TM, Callaway CW, Hostler D. Core temperature cooling in healthy volunteers after rapid intravenous infusion of cold and room temperature saline solution. Annals of emergency medicine 2008;51:153-9.

49. Casa DJ, DeMartini JK, Bergeron MF, et al. National Athletic Trainers' Association position statement: exertional heat illnesses. Journal of athletic training 2015;50:986-1000.

50. Gaudio FG, Grissom CK. Cooling methods in heat stroke. Journal of Emergency Medicine 2016;50:607-16.

51. Smith J. Cooling methods used in the treatment of exertional heat illness. British journal of sports medicine 2005;39:503-7.

52. Lipman GS, Eifling KP, Ellis MA, Gaudio FG, Otten EM, Grissom CK. Wilderness Medical Society practice guidelines for the prevention and treatment of heat-related illness: 2014 update. Wilderness & environmental medicine 2014;25:S55-S65.

53. Leicht AS, Sinclair WH, Patterson MJ, et al. Influence of postexercise cooling techniques on heart rate variability in men. Experimental physiology 2009;94:695-703.

54. Miller ML. Clinical manifestations and diagnosis of rhabdomyolysis. UpToDate, Version 2014;11.

55. Helman R. Medscape reference: heatstroke [online]. Updated May 2017. 2017.

56. Ekegren C, Gabbe B. Ten-year incidence of sport and recreation injuries resulting in major trauma or death in Victoria. Journal of Science and Medicine in Sport 2017;20:e107-e8.

57. Australasian College of Sport and Exercise Physicians. Advanced Course in the Management of Sporting Trauma (MOST). 2018.

58. Roppolo LP, Wigginton JG, Pepe PE. Intravenous fluid resuscitation for the trauma patient. Current opinion in critical care 2010;16:283-8.

59. Mapstone J, Roberts I, Evans P. Fluid resuscitation strategies: a systematic review of animal trials. Journal of Trauma and Acute Care Surgery 2003;55:571-89.

60. National, Clinical Guideline Centre UK. Major Trauma: Assessment and Initial Management. 2016.

61. Levett D, Vercueil A, Grocott M. Resuscitation fluids in trauma 1: why give fluid and how to give it. Trauma 2006;8:47-53.

62. De Crescenzo C, Gorouhi F, Salcedo ES, Galante JM. Prehospital hypertonic fluid resuscitation for trauma patients: a systematic review and meta-analysis. Journal of Trauma and Acute Care Surgery 2017;82:956-62.

63. Dretzke J, Burls A, Bayliss S, Sandercock J. The clinical effectiveness of pre-hospital intravenous fluid replacement in trauma patients without head injury: a systematic review. Trauma 2006;8:131-41.

AIS.gov.au

@theAIS #theAIS

Leverrier Street Bruce ACT 2617
PO Box 176 Belconnen ACT 2616
+61 2 6214 1111