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## The Australasian Society for Motorsports Medicine and Rescue

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### Race control

Welcome to the fifth edition of the ASMMR newsletter. It almost feels like an anniversary. Hopefully recipients of the newsletter have been finding it helpful, or at least interesting. If there are burning issues that individuals would like discussed or contribute to, please send an e-mail to [mmpartlin@ausdoctors.net](mailto:mmpartlin@ausdoctors.net)

Since the last issue, Australia has seen the return of the WRC to its shores. From its ancestral home in WA, where it was held for nineteen unbroken years until two years ago, it has migrated to the Northern Rivers region of NSW. Rally HQ and Service was based in the Kingscliff area, south of Tweed heads. The super-special stage was an unusual street circuit in Murwillumbah, with three cars setting off 15 seconds apart in a chase format. Gone was the red bull dust and ball-bearing gravel, replaced with a mixture of fast stone gravel, twisting dirt rainforest and occasional asphalt segments.

Loeb's pace notes held up this time, leading to one of the closest final finishing times, only to be leapfrogged by Hirvonen after the champagne spray due to a technical irregularity that resulted in a one minute penalty for the top three placed Citroen cars.

Man of the match ... Sebastian Ogier. A great drive from a young contender, who very nearly didn't get to compete, but not only kept up with the lead drivers, he beat them on several stages.

Hopefully, the unruly few who attempted to derail the rally, resulting in two cancelled stages, will not succeed in cutting short an otherwise successful return of the WRC event to Australia or NSW.

Good luck.

Matthew Mac Partlin



## Clinical review

### Exercise associated muscle cramps (EAMC)

An evidence based review of the proposed aetiologies of EAMC  
M P Schwellnus. *Br. J. Sports Med.* 2009;43:401-408

A common complaint, defined as “painful, spasmodic and involuntary contraction of skeletal muscle that occurs during or immediately after exercise.”

Three prevalent aetiological hypotheses:

- dehydration
- electrolyte depletion
- altered neuromuscular control

#### Dehydration and electrolyte depletion

First described over 100 years ago in miners working in hot, humid conditions, where muscle cramps were associated with profuse sweating. However, it has also been documented in moderate and cool temperatures. Not directly associated with a rise in core body temperature. Passive warming does not induce EAMC and cooling does not alleviate it.

Noted electrolyte disturbances associated with EAMC:

- i. hypochloraemia
- ii. hyperkalaemia
- iii. hypomagnesaemia
- iv. hypocalcaemia

However, the scientific methodology in all associated studies was in the form of case reports or case series, with no control groups. There is no published study that has shown abnormal serum electrolytes at the time of acute EAMC, when compared with non-cramping control athletes. Several prospective cohort control trials in marathon runners and triathletes have demonstrated a lack of difference in serum electrolytes between those who developed EAMC and those who did not. Furthermore, they showed no significant electrolyte changes in EAMC athletes as their cramps resolved (*Br J Sports Med* 2004;38:488–92. *Med Sci Sports Exerc* 2005;37:1081–5.)

Alternative electrolyte depletion and dehydration hypothesis suggests loss of sodium and water through sweating results in interstitial volume depletion with resultant deformation of nerve endings and concentration of neurotransmitters to cause pain and muscular twitching. Very little supportive evidence. The few studies that exist lack control groups, rely on self-reported previous history of EAMC, were not performed at the time of EAMC occurrence and have small sample sizes. Multiple potential confounders were present. When the data from trials were pooled, the mean sweat sodium content was in fact equal to or higher in those without a history of EAMC than those with, conflicting with the proposed hypothesis.

Dehydration alone has not been shown to be more likely in EAMC affected athletes. In fact, in the same two prospective cohort trials mentioned above (*Br J Sports Med* 2004;38:488–92. *Med Sci*

Sports Exerc 2005;37:1081–5.) EAMC affected athletes were more likely to be less dehydrated than non-EAMC affected controls, based on pre and post-event weights.

Finally, serum electrolyte and osmolar disturbances induced during dialysis can result in systemic muscle cramps and can be ameliorated by normalising these disturbances by “sodium profiling”. However, EAMC in general is not a systemic event but affects localised, working muscle groups. The hypothesis does not explain why a systemic disturbance only affects localised muscle groups.

### Altered neuromuscular control

A trial in 1957 on 115 college students first demonstrated that sustained, maximal contraction with the muscle in a shortened position (suboptimal length-tension relationship) resulted in a higher incidence of cramping after exercise, that muscle cramping was electrically active on an EMG and that the cramping could be alleviated by passive stretching (EEG Clin Neurophysiol 1957;9:139–47).

However, altered neuromuscular control as a mechanism for EAMC specifically was first suggested in 1996, at a South African symposium on “muscle fatigue”. Several observational trials led to the generation of a potential mechanism of altered neuromuscular control arising from “muscle fatigue”, which results in abnormal myocyte contraction and relaxation through disturbed afferent and efferent pathways, ultimately eventuating in muscle cramps.

The hypothesis brought into play:

- environmental conditions – (Observational trials only, with several confounding factors. Correlation suggested, but not clearly causative)
- inadequate muscle conditioning for the intended level of activity and intensity and duration of the activity (Several retrospective observational trials and one prospective cohort study in 2006 of 210 South African Ironman athletes suggest reasonably strong correlation, but again not clearly causative)
- the adequacy of muscle energy stores (glycogen, fatty acids, ATP – no trials specifically examine this)
- the possibility of genetic predisposition

It further may explain why EAMC occurs in localised working muscle groups rather than generally. It also provided a means to explain why pre-exercise stretching may prevent cramping (though there are trials that cast doubt upon this practice) and why effective treatment of EMAC includes stretching out the affected muscle group.

The mechanism is thought to revolve around inadequately functioning afferent stretch receptors with associated, or subsequent, excessive activity of motor neurons, resulting in inappropriate muscle contraction, causing pain and spasm.

Evidence to support this hypothesis includes:

- trials showing that cramping can be induced by voluntary, sustained muscle contraction before or after exercise (EEG Clin Neurophysiol 1957;9:139–47, Brain 1995;118:983–93)
- trials showing that cramping can be induced by electrical stimulation of motor nerves (J Neurophysiol 2007;98:1102–7, Muscle Nerve 2008;37:90–100.)
- electrical stimulation of the Golgi apparatus (tendon stretch receptors) results in inhibition of  $1\alpha$  motor neurons (which stimulate muscle contraction) leading to muscle relaxation and

- alleviation of muscle cramps (J Neurophysiol 2007;98:1102–7)
- animal models have demonstrated fatigueability of the inhibitory activity of stretch receptors and an increased firing rate of  $\alpha$  motor neurons with sustained exertion (Med Sci Sports Exerc 1986;18:69–74, Med Sci Sports Exerc 1985;17:445–50.)
- cramping muscles in athletes who suffer EAMC, exhibit higher levels of EMG activity than the non-cramping muscles in the same athletes, between bouts of EAMC, suggesting a possible “cramping-prone state” (small observational trial: Med Sci Sports Exerc 2005;37:1081–5)

The article summary concludes that there is little evidence and none of it high quality, to support the dehydration and / or electrolyte depletion hypotheses for exercise-associated muscle cramps, but mounting evidence with several prospective trials that suggest altered neuromuscular control is the major mechanism.

The article did not extend to discussing how the proposed aetiologies might improve prevention or management strategies for exercise-associated muscle cramps, other than to mention that there is evidence to support the use of passive stretching to alleviate cramps once they occur and a small (n = 18) lab-based trial that showed an association between the use of an oral solution containing electrolytes and carbohydrate and a delay, but not reduction, in the occurrence of EAMC (J Athl Train 2005;40:71–5).

The author acknowledged that he had been in receipt of funding from Gatorade for the production of this article for a 2007 conference and it should be noted that the author quoted several of his own papers that cast doubt upon the former hypotheses and support the neuromuscular control hypothesis; so the review presented may not be without bias. Overall, an article of some interest that may help explain the phenomenon to patients, but does not provide any influence on how we manage a cramping driver at an event. We will still stretch out the affected muscle group because it works, advise the maintenance of hydration status because it is sensible and check for any other condition or injury that might be contributing.



## Recent race results

### World Rally Championship

After 10 of 12 rounds. Next round [RACC Rallye de España](#) 2<sup>nd</sup> – 4<sup>th</sup> October.

1. <b>M. HIRVONEN</b> 78	6. P. SOLBERG 25	11. M. OSTBERG 7
2. S. LOEB 73	7. M. WILSON 23	12. K. AL-QASSIMI 6
3. D. SORDO 50	8. S. OGIER 20	13. E. NOVIKOV 4
4. J-M LATVALA 36	9. F. VILLAGRA 15	14. C. ATKINSON 4
5. H. SOLBERG 29	10. C. RAUTENBACH 8	



Descending from the winners' podium

Environmental outcome of Repco Rally Australia:

All-up for the 344kms of rally activity we recorded a total of two lizards, four snakes, nine birds and a single mammal, which was much less than expected for this number of competing vehicles. Most importantly, no threatened fauna, including koalas, were killed or injured. – Dr Stephen Phillips (WRC.com)

### Formula 1 Grand Prix

<b>1. Jenson Button 80</b> 2. Rubens Barrichello 66 3. Sebastian Vettel 54 4. Mark Webber 51.5 5. Kimi Räikkönen 40 6. Nico Rosberg 30.5 7. Lewis Hamilton 27	8. Jarno Trulli 22.5 9. Felipe Massa 22 10. Heikki Kovalainen 20 11. Fernando Alonso 20 12. Timo Glock 16 13. Nick Heidfeld 12 14. Giancarlo Fisichella 8	15. Robert Kubica 8 16. Adrian Sutil 5 17. Sebastien Buemi 3 18. Sebastien Bourdais 2 19. Kazuki Nakajima 0 20. Nelson Piquet 0
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After 12 of 17 rounds. Next event Italy 13th September and things are not looking great for either Renault or the Piquets.



### V8 Supercars

After L&H 500 Phillip Island (10<sup>th</sup> event). Next round [Supercheap Auto Bathurst 1000](#)

<b>1. Jamie Whincup 804</b> 2. Will Davison 690 3. Steven Johnson 573 4. Lee Holdsworth 534 5. Rick Kelly 53	6. Garth Tander 504 7. Craig Lowndes 501 8. Shane Van Gisbergen 453 9. Jason Richards 417 10. Fabian Coulthard 414	11. Steven Richards 399 12. Mark Winterbottom 396 13. Cameron McConville 378 14. James Courtney 374
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## MotoGP

1. <b>Valentino ROSSI</b> 237 2. Jorge LORENZO 207 3. Dani PEDROSA 157 4. Casey STONER 150	5. Andrea DOVIZIOSO 133 6. Colin EDWARDS 123 7. Loris CAPIROSSI 97 8. Alex DE ANGELIS 88	9. Randy DE PUNIET 88 10. Marco MELANDRI 87 11. Chris VERMEULEN 84 12. Toni ELIAS 80
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After 13 rounds. Next round Grande Premio De Portugal 4th October.



### **Tips for using the Airtraq**

Following the review of airway management options presented in Issue 3, these tips have been provided by an experienced retrievalist anaesthetist.

- A size 3 Airtraq (the green one) will accommodate a size 6.0 to 7.5 ETT and is easier to manipulate into position than the bigger size 4 (the blue one – size 7.0 to 8.5 ETT).
- Turn on the light as soon as you start preparing for intubation. This helps to heat the lens and prevents fogging. (The batteries will last up to 12 hours with the light left on)
- Place lubricant along the side channel
- Suction the oropharynx and supraglottic regions thoroughly with the aid of a standard MacIntosh blade. Secretions and blood will coat the lens, obscuring your view
- The lens is wide-angle, so once you can see the cords, you don't need to get any closer
- Place the view of the vocal cords in the middle or at the bottom of the lens field of vision, not at the top, otherwise the ETT may go down the oesophagus
- Once in place, peel the ETT away sideways from the Airtraq channel before withdrawing the Airtraq, to avoid dislodging the ETT



## Caught by the cameras



Nathan Quinn's race at Repco Rally Australia ends in the bush. Can you spot the car off the side of the road?

