Swimming Pools and Cardiovascular Collapse in the Young

Robin Martin
Bristol Royal Hospital for Children and Bristol Heart Institute

Bristol Congenital Heart Centre

Case of Interest – BBC website

Boy's pool death was 'drowning'

Nathan Matthews (right) was an 11-year-old boy who stopped breathing during a school swimming lesson at a leisure centre, died from drowning, tests have shown.

Medico-Legal Case

- Reasonable swimmer in supervised swimming lesson in shallow end of pool
- Relay race where has to dive to pick up a "sinker"
- Went under water and noticed quickly by staff to be motionless at bottom of pool
- CPR commenced within a couple of minutes of him going underwater
- In VF when paramedics arrived – could not be resuscitated

Cause of death?

- Post mortem examination normal
- No previous or family history
- Death certified as being due to drowning
- I presented a report for the Coroner’s Inquest
- My opinion was that cause of death likely to be an undiagnosed channelopathy (LQT or CPVT).

Evidence for cardiac cause for drowning

- Was a capable swimmer and was in the shallow end
- Well supervised and no distress identified
- In VF – unusual arrest arrhythmia in children
- Normal gross post mortem examination but no “molecular autopsy” undertaken

Clinical Opinion

- Any child who has a serious faint or cardiac arrest whilst swimming should be considered to have a channelopathy until proven otherwise

Literature

Circulation

JOURNAL OF THE AMERICAN HEART ASSOCIATION

American Heart Association®

Learn and Live℠

- **Spectrum and Frequency of Cardiac Channel Defects in Swimming-Triggered Arrhythmia Syndromes**

  Grace Choi, Laura J. Kopplin, David J. Tester, Melissa L. Will, Carla M. Haglund and Michael J. Ackerman

  Circulation 2004;110;2119-2124; originally published online Oct 4, 2004;

Mayo clinic paper

- 388 patients referred for genetic testing
- 43 (11%) had a personal or family history of drowning or near drowning
- 28 had LQT1
- 2 LQT2
- 9 CPVT
- Only 4 negative so far

Implications of paper

- Swimming related deaths or serious events should be tested for Long QT syndromes and Catecholaminergic Polymorphic Ventricular Tachycardia
- DNA should be stored for future analysis and family members should be screened with detailed family history

Why is swimming a trigger?

- Exertion common trigger of events
- Hyperventilation and voluntary apnoea
- Diving reflex combines sympathetic and parasympathetic stimulation
- Cold water face immersion prolongs the QT interval
- Batra et al J Pediatr 2002;141:283-4 described 12 year old with long QT and ICD – VF on diving in

Sudden Death

- 30% of sudden deaths are autopsy negative
- Majority of affected individuals probably have a channelopathy

DOH Website

- **New sudden cardiac death database to save lives**
- 7 November 2008
- A database launched today will help identify the incidence and causes of sudden cardiac death. It will save the lives of people who may currently be at risk from the inherited heart condition that can strike without warning, it was announced today.
- Designed by pathologists and cardiologists, and funded by the Department, the database will be a key tool in understanding the incidence and causes of inheritable conditions that can cause sudden cardiac death.
- Sudden cardiac death can happen unexpectedly in apparently fit and healthy people. The main cause for those under the age of 35 is an inheritable heart condition.
- The new database will help pathologists record cases referred to them by coroners. This information will ultimately allow doctors to understand better where and why these inheritable heart conditions are occurring, and so help save lives.
- With a greater knowledge of the incidence, prevalence and causes of sudden cardiac death, doctors will be able to identify better people at risk from one of these conditions and help them get access to the services they need. Close family members of victims of sudden cardiac death will be referred to specialist inherited cardiac conditions centres where they will be offered counselling and support.

Needs ?

- Awareness in the Coronial Service
- Molecular autopsy and family assessment of autopsy negative sudden death
- Setting up of inherited cardiac disorders clinics now starting up

What about swimming?

- Presented data to Lifesavers Association
- Many delegates reported instances of death in the swimming pool in children and young adults
- Some lifesavers had been accused of manslaughter due to concerns over supervision

Competitive swimmers

- Sudden death appears rare and high level athletes are already screened
- In USA – Maron et al study of 1866 athletes who died or experienced cardiac arrest. Only 46 were engaged in swimming related activities

Circulation 2009;119:1085-1092

Drowning?

- Is sudden cardiac death masquerading as drowning?
- In USA 9 unintentional drownings per day (CDC 2006)
- 19% of drowning deaths in children occur in public pools with certified lifeguards present
- For every drowning death it is estimated there are 1-4 nonfatal events requiring hospitalization
- 5000 children <14 hospitalized - 15% die 20% permanent neurodisability

Drowning

- Australia 1.35 deaths /100,000 per year
- UK – RoSPA 2005 435 accidental drownings – 39 were children.
- 40% drowned whilst swimming or playing in the water
- So probably up to 16 deaths per year- unknown percentage will have channelopathy

Swimming events and drownings Conclusions

- Needs to be better awareness in the Coronial Service of channelopathies
- DNA storage needs to be undertaken and this has been a problem
- Any blackout or arrest in water should be investigated for long QT and CPVT
- Any unexplained drowning should be managed similarly to sudden death with family evaluation and DNA analysis