

IN THE CORONERS COURT
OF VICTORIA
AT MELBOURNE

Court Reference: COR 2010 2825

FINDING INTO DEATH WITHOUT INQUEST

Form 38 Rule 60(2)

Section 67 of the Coroners Act 2008

I, AUDREY JAMIESON, Coroner having investigated the death of REAGAN LEON MILSTEIN

without holding an inquest

find that the identity of the deceased was REAGAN LEON MILSTEIN

born on 25 November 1995

and the death occurred on 22 July 2010

at Monash Medical Centre, Clayton 3168

from:

1 (a) COMPLICATIONS OF CEREBRAL ARTERIAL GAS EMBOLISM

1 (b) SCUBA INCIDENT

Pursuant to section 67(2) of the **Coroners Act 2008**, I make findings with respect to **the following circumstances:**

1. Reagan Milstein was fourteen years of age at the time of his death. He lived at 19 Lovell Street, Hawthorn East with his mother, Tamara Newing.
2. Reagan was certified as a junior open water diver, licence No: 1001AA9052, conducted through the Professional Association of Diving Instructors on 31 December 2009. Reagan had been deemed medically fit to be a SCUBA diver, which is a requirement of the certification process. His medical history was of no significance.

Surrounding Circumstances

3. On 30 June 2010, Reagan travelled to Malaysia with his father, Kevin Milstein, for a scuba diving holiday and for further certification of his diving qualifications. Reagan already had a

total of four hours of dive time made up of six open water dives and five confined water dives.¹

4. At approximately 9.50am on 1 July 2010, Reagan commenced the first of two open water dives. The dive was limited to eighteen metres of sea water (msw) with five stops at five minutes each; the total dive time was forty-five minutes. Reagan dived to sixteen msw and completed his dive without incident, although he complained of sneezing during the dive and an itchy chest following the dive.
5. At approximately 11.50am that morning, Reagan and his father commenced their second dive. This dive was also to be limited to eighteen msw and a total dive time of forty minutes with the required five stops of five minutes each. During this dive, the dive master noted Reagan was having difficulties. He ascended with Reagan and boarded the boat.
6. In the boat Reagan became unconscious and emergency procedures were immediately commenced. Reagan was conveyed by boat to the mainland where they were met by ambulance personnel. Reagan was thereafter conveyed to the nearby hospital. Issues of expertise arose whereby none of the local doctors were trained nor had any experience with diving incidents.
7. Reagan's condition continued to deteriorate. Reagan's father contacted his travel insurers and thereafter arrangements were made to have Reagan transported to a suitable hyperbaric chamber to treat his dive illness. At this point thirty-two hours had elapsed since the diving incident.
8. Treatment continued in both Malaysia and Singapore where he had been transferred; however, his prognosis was poor and arrangements were made to repatriate Reagan to Australia. Reagan was admitted to Monash Medical Centre (MMC) on 20 July 2010 and died on 22 July 2010.

¹ Five confined water dives are required as part of the certification process for a diving qualification. PADI (Professional Association of Dive Instructors) define confined water dives as those undertaken in a swimming pool or a body of water with pool-like conditions. <http://www.padi.com/scuba/scuba-diving-guide/start-scuba-diving/scuba-certification-faq/default.aspx>

INVESTIGATIONS

Medical Investigation

9. Dr Linda Iles, Forensic Pathologist at the Victorian Institute of Forensic Medicine performed an external examination of Reagan's body, examined a post-mortem CT scan, the Police Form 83, the MMC records and the medical deposition. Based on this information and in the absence of a full post mortem examination, Dr Iles reported that it was reasonable to attribute Reagan's death to complications of cerebral arterial gas embolism due to a scuba incident.

Police Investigation

10. Constable Anthony Kruska, Oakleigh Police Station, undertook the Police investigation and the preparation of the coronial brief.

Coroners Prevention Unit

11. The Coroners Prevention Unit (CPU)² was requested to provide additional research information to support the investigation into Reagan's death, including:
 - the adequacy of pre-dive medicals including whether a chest X-ray should be required; and
 - to identify information available to Australian travellers regarding safety preparations for overseas recreational scuba diving holidays.

Adequacy of the pre-dive medical

12. The Health and Medical Investigation Team (HMIT)³ reviewed Reagan's pre-dive medical assessment, his development of symptoms and eventual death noting that during Reagan's medical treatment and post-mortem examination, a large cyst was located in his left lung. Pre-dive medicals do not require a chest x-ray, however, while a chest x-ray may have identified

² The Coroners Prevention Unit is a specialist service for coroners created to strengthen their prevention role and provide them with professional assistance on issues pertaining to public health and safety.

³ The HMIT sits within the Coroners Prevention Unit and assists coronial investigations by reviewing and evaluating relevant medical evidence on behalf of coroners and assisting them to identify factors that may help improve patient safety and risk management in the healthcare settings. HMIT personnel are comprised of practising Physicians and Clinical Research Nurses who draw on their medical, nursing and research experiences, skills and knowledge to independently evaluate clinical evidence for the investigation.

Reagan's lung cyst and thus excluded him from diving, HMIT advised the coroner that the cyst did not contribute to his development of Reagan's cerebral arterial gas embolism (CAGE).

Review of the incident and medical treatment

13. A review of the incident and Reagan's medical treatment was conducted by the Divers Alert Network (DAN) Asia-Pacific, involving travel to the sites involved and interviews with the treating physicians.⁴ The findings of the review were published⁵ and speculated as to the cause of the CAGE as potentially related to:

- The lung cyst (discounted by HMIT);
- A patent foramen ovale (PFO); or
- An atrial septal defect (ASD).

14. As no autopsy was conducted, no definitive cause was identified.

15. The review also detailed clear deficiencies in the treatment received by Reagan from the time he was retrieved from the water:

- No oxygen was available on the dive boat (the prompt provision of 100% oxygen has been known to rapidly improve CAGE symptoms);
- The oxygen provided at the dive operators base was via a mask without a reservoir, which could not have provided 100% oxygen;
- The oxygen he received at the hospital was through a simple face mask, which the authors estimate would have provided an inspired oxygen concentration of less than 40%,⁶

⁴ Personal Communication, John Lippmann, Executive Director DAN Asia Pacific.

⁵ Lippmann, J., Fock, A. and Arulanandam, S. 2011. The diving doctor's diary: Cerebral arterial gas embolism with delayed treatment and a fatal outcome in a 14-year-old diver. *Diving and Hyperbaric Medicine*, 41(1): 31-34.

⁶ The review noted that a non-rebreather mask with a reservoir was required to provide high concentrations of oxygen.

- Reagan was treated by doctors with no experience in diagnosing or treating decompression illness – a suitably qualified doctor diagnosed Reagan with decompression illness some six hours after the dive; and
 - A decompression chamber was not accessed until thirty-two hours post-dive.
16. The review considered that a divers' emergency hotline (such as that operated by DAN) should have been immediately contacted post-dive. The DAN Asia-Pacific Diving Emergency Service (DES) hotline is a 24-hour service that is based at the Hyperbaric Unit at the Royal Adelaide Hospital. It is contactable from outside Australia, and following an initial triage from a paramedic, callers are able to speak to the on-call hyperbaric doctor within 2-5 minutes.⁷

A consideration of PFO and ASD for pre-dive medical risk assessment

17. In foetal hearts, there is an opening between the left and right atria (the “foramen ovale”), which allows oxygenation by the placenta and distribution of the oxygenated blood through the body. Very soon after birth, a flap valve closes over the foramen ovale and eventually becomes a part of the atrial wall (septum). In approximately 30% of individuals, this closure is incomplete and a patent (persistent) foramen ovale (PFO) remains, which is a potential route for venous blood to enter the arterial circulation. This could allow bubbles to enter the arteries and bypass the filter-like effect of the lungs.⁸
18. In rare cases, the flap valve is completely missing, and a persistent opening remains, which is termed an atrial septal defect (ASD). An ASD is contraindicated for diving.⁹
19. A heart with a PFO is considered a natural cardiac variant, and the majority of individuals are asymptomatic. It cannot be detected by physical examination, but can be detected with a bubble contrast echocardiogram. The general consensus among diving physicians is that screening for PFO is not warranted as the risk of a decompression event is very low¹⁰

⁷ http://www.danasiapacific.org/main/emergency/des_hotline.php

⁸ Bove, A.A. and Moon, R.E. 2004. Patent Foramen Ovale – Is it important to divers? *Alert Diver*. September/October 2004.

⁹ *Ibid.*

¹⁰ Bove, A.A. (ed) 2004. *Bove and Davis' Diving Medicine*. 4th Edn, Elsevier Science, Philadelphia.

(estimated incidence of 2.28 per 10,000 dives for divers with a PFO),¹¹ and does not justify the echocardiography of all divers.¹² An expert diving screening panel considered the issue of PFOs' as recently as 2011, where they determined that a PFO was not a contraindication to diving.¹³ There is strong support, however, for the consideration of echocardiography studies when decompression illness occurs following an apparently safe dive schedule.¹⁴

Preparations for overseas diving holidays

20. The CPU conducted an extensive Internet review of the information available to people who are considering undertaking an overseas diving holiday. The available material was almost exclusively promotional and tourism-focussed in nature, including that of the Professional Association of Diving Instructors (PADI).¹⁵ The information from hyperbaric medical associations was clinically focussed. The CPU were unable to identify any information or resources that could assist those preparing to dive overseas to undertake any systematic pre-trip or pre-dive safety planning.
21. The CPU considered that many of the circumstances that contributed to Reagan's death, or at least the failures to provide him with adequate medical care following the dive, could be anticipated and preparations put in place either before departing overseas, or at the dive site itself. To achieve this, the availability of this information to the community would be critical to assist persons in this situation. The CPU therefore concluded that information to assist safety preparations for overseas diving holidays should be developed, and disseminated through prominent, readily available channels.
22. Recreational sports in Australia are generally overseen by sporting associations, Government agencies promoting sports and safety, as well as occupational health and safety regulators. Australians undertaking recreational sports overseas do not have the same degree of oversight, particularly in developing nations. Australian citizens overseas may have consular support

¹¹ Bove, A.A. 1998. Risk of decompression sickness with patent foramen ovale. *Undersea & Hyperbaric Medicine*, 25:175-178.

¹² *Ibid.* 8.

¹³ Mitchell, S.J., Bove, M.D. 2011. Medical screening of recreational divers for cardiovascular disease: Consensus discussion at the Divers Alert Network Fatality Workshop. *Undersea & Hyperbaric Medicine*, 38(4): 289-296.

¹⁴ *Ibid.* 8.

¹⁵ Scuba diving is largely self-regulated, and there are variety of organisations that certify training and facilities. PADI is the largest diving certification association. It trains divers and certifies recreational diving operations and resorts.

from the Department of Foreign Affairs and Trade, however the safety of travellers is just one of an extensive range of responsibilities of the Department. The CPU therefore considered that a partnership approach with an expert content-provider and an official information portal may be the most appropriate way to disseminate overseas diving safety information.

Diver Alert Network (DAN) Asia-Pacific¹⁶

23. The CPU contacted and met with John Lippmann OAM, Executive Director and Director of Training at DAN Asia-Pacific. Mr Lippmann is also the editor of the *Alert Diver* magazine. In the January – April 2011 edition, he published an article entitled “Planning a Dive Trip”, which provides information and advice to people preparing to dive overseas. The article was written in response to the circumstances of Reagan’s death, and provides practical advice in easily-understood terms. DAN also began promoting the concept of divers taking their own non-rebreather masks with them overseas.

Better Health Channel, Department of Health Victoria

24. The CPU approached the content manager of the Better Health Channel (BHC) website managed by the Department of Health to have discussions regarding the development of information regarding overseas diving safety. The BHC is a highly regarded information portal and relies on expert content providers to ensure the quality of its information.¹⁷ The BHC content is also highly ranked by Internet search engines.
25. The CPU met with Greg Stenton, Director of Business Planning and Communications, and the Department’s legal counsel. The CPU outlined the matter under investigation, and enquired whether it would be appropriate for DAN to provide content to the BHC in relation to overseas diving safety. Mr Stenton advised that the BHC was no longer hosting information regarding “safety” issues, but was focussing on issues of “health” and “wellbeing”. Mr Stenton considered the matter of diving safety to be in the “safety” category, and thus out of scope for the BHC. It was suggested that the CPU approach the Commonwealth Department

¹⁶ DAN was formed in 1980, it was then called the National Divers Accident Network, and its goal was to provide a twenty-four hour medical emergency contact point for diving accidents.

DAN provides members with worldwide emergency evacuation coverage,¹⁶ optional diving medical insurance, the 24-hour emergency hotline, a Diver Alert periodical and safety advice and training. They also conduct research into dive safety and diving incidents. DAN Asia-Pacific conduct an ongoing clinical and safety review of all Australian diving fatalities with the agreement of all State and Territory coroners’ courts.

¹⁷ <http://www.betterhealth.vic.gov.au/>

of Foreign Affairs and Trade, who manage the Smartraveller website for Australians travelling overseas.

Smartraveller - Department of Foreign Affairs and Trade

26. The CPU contacted the Commonwealth Department of Foreign Affairs and Trade (DFAT), who provide the Smartraveller website.¹⁸ This website provides travel advice to Australians intending to travel overseas, including information on safety, security and available consular services. A representative of the Consular Information Section provided the CPU with a number of references to diving safety from the Malaysian travel advice information and from other areas of the site.
27. The consular representative also indicated that information for Australians participating in adventure sports has been increasingly important due to the growth of overseas travel and the high number of consular cases seen as a result. These activities have included rafting, tubing, mountain climbing, diving and running with the bulls in Spain.
28. The Smartraveller does include references to diving safely whilst overseas however, there is clearly scope to provide, or link to information which provides specific and expert guidance in this regard. The consular representative indicated to the CPU that DFAT were considering ways of incorporating the overseas diving preparation information from the DAN website into Smartraveller, alternatively a link to the information could be provided in the general advice to travellers or from the specific country information.

COMMENTS

Pursuant to section 67(3) of the **Coroners Act 2008**, I make the following comment(s) connected with the death:

1. A review of Reagan's' post-dive treatment identified a range of deficiencies due to the lack of availability of necessary equipment and supplies, and a lack of experience in diagnosing and treating decompression illness by his doctors.

¹⁸ <http://www.smartraveller.gov.au/>

2. At the time of the incident, it appears that there was a lack of available information or resources to assist Australians who intend to dive overseas, to enable them to make an informed risk assessment of their dive operator or to undertake suitable preparations in case of an emergency.
3. The DAN Asia-Pacific formed a similar view following Reagan's death, and developed an information resource for its members to assist in their planning. While this resource has been made freely available on the DAN website, its visibility is limited by a relatively low search engine ranking. Recreational diving has a variety of representative organisations, making the centralised repository of safety information difficult. In addition, most recreational diving associations are strongly focussed on promotion and tourism, and no other resources were found relating to the risks of diving overseas. Nevertheless, I commend DAN Asia-Pacific for their thorough "on the ground" investigation of the management of Reagan's medical emergency, and for developing an information resource to allow those intending to dive overseas to undertake appropriate pre-trip and pre-dive assessments.
4. The DFAT website Smartraveller, provides Australians intending to travel overseas with travel advice for different destinations, including advisories regarding personal safety and potentially unsafe activities. It is however the only Commonwealth agency with the remit to provide assistance to Australians overseas and, given the centralised provision of travel advice on their Smartraveller website, this may be an appropriate medium by which to provide information regarding preparations to undertake recreational diving overseas.

RECOMMENDATIONS

Pursuant to section 72(2) of the **Coroners Act 2008**, I make the following recommendation(s) connected with the death:

1. That the Commonwealth Department of Foreign Affairs and Trade seek to partner with the Divers Alert Network Asia-Pacific to develop sufficiently detailed advice on the Smartraveller website to allow Australians to undertake appropriate safety assessments and preparations when considering recreational diving overseas. This should be undertaken to ensure that Australians who experience diving emergencies overseas can promptly access the appropriate first aid and medical care to minimise the risk of debilitating illness or death.

2. The Department of Foreign Affairs and Trade should also seek to notify the recreational diving training and certification organisations operating in Australia of the presence of this information, encouraging recreational divers who intend to dive overseas to review the Smartraveller website in order to appropriately and safely prepare for their trip.

FINDING

I accept and adopt the medical cause of death as identified by Dr Linda Iles and find that REAGAN LEON MILSTEIN died from complications of cerebral arterial gas embolism due to a SCUBA incident.

And I further find that cause of Reagan's cerebral arterial gas embolism is unable to be determined.

Pursuant to rule 64(3) of the Coroners Court Rules 2009, I order that this Finding be published on the Internet.

I acknowledge the assistance of the Coroner's Prevention Unit in this matter.

I direct that a copy of this finding be provided to the following:

Mr Kevin Milstein on behalf of Reagan's family.

Mr Dennis Richardson, Secretary, Department of Foreign Affairs and Trade

Mr John Lippmann OAM, Executive Director, DAN Asia-Pacific

Associate Professor Michael Bennett, President, South Pacific Underwater Medicine Society,
C/- Australian and New Zealand College of Anesthetists

The Honourable Bob Carr, Minister of Foreign Affairs

Signature:


AUDREY JAMIESON
CORONER

Date: 23 October 2012

