South Pacific Underwater Medicine Society

52nd Annual Scientific Meeting

12-17 May 2024

The Pearl Resort, Pacific Harbour, Fiji

A PLUNGE INTO RECREATIONAL DIVING AND DIVER HEALTH

Scientific Programme and Abstracts

SPUMS acknowledges the generous support given by the Australasian Diving Safety Foundation

SPUMS
South Pacific Underwater Medicine Society

Scientific Programme
SPUMS ASM 2024

A plunge into recreational diving and diver health

12th -17th May

Pearl Resort, Pacific Harbour, Fiji



PROGRAMME

SUNDAY EVENING - *Welcome Reception*

	Session 1 (1400 - 1600)	*Session 2* (1630 - 1830)
MONDAY:	PFO Overview and video	Free papers
TUESDAY:	PFO Diagnosis, management, cases	PFO JPS update
WEDNESDAY:	DCI update	Free papers / AGM
THURSDAY :	Immersion Pulmonary Oedema	IPO JPS
FRIDAY:	Free Papers	Free papers / ASM 2025

Conference Dinner: 1900 - late!

SPUMS ASM 2024 Programme at a glance

Monday 13th May 2024		
Session 1		
Chair: Dr Neil Banham		
Time	**Talk Title**	**Speaker**
1400-1405	Welcome	
1405-1500	Persistent (Patent) Foramen Ovale (PFO) Diving- History and current practice	Dr Peter Wilmshurst (Keynote Speaker)
1500-1515	Questions and Discussion	
1515-1600	PFO Closure (Video): Practical tips and problems	Dr Mark Turner
Break 1600-1630		
Session 2 (Free Papers)		
Chair: Dr Ian Gawthrope		
1630-1700	HBOT for a patient on ECMO	Dr Bridget Devaney
1700-1730	PFO, DCI and Right Ventricular Dilatation	Dr Jeremy Mason
1730-1830	Sudden cardiac arrest – Could it be you?!	Dr Mark Salib

Tuesday 14th May 2024		
Session 1		
Chair: Prof David Smart		
Time	**Talk Title**	**Speaker**
1400-1500	PFO Diagnosis and management	Dr Peter Wilmshurst
1500-1515	Questions and Discussion	
1515-1540	PFO Case reports	Dr Sarah Lockley
1540-1600	Overview of Colonial War Memorial Hospital Suva	Dr Luke Nasedra
Break 1600-1630		
Session 2		
Panel: David Smart, Simon Mitchell, Peter Wilmshurst, Neil Banham, Mark Turner		
1630-1800	SPUMS / UKSDMC PFO and Diving JPS update	
1800-1830	SPUMS PFO Patient Information e-Brochure for consensus	Dr Elisabete da Silva

Wednesday 15th May 2024		
Session 1		
Chair: Dr Cathy Meehan		
Time	**Talk Title**	**Speaker**
1400-1500	Update on Decompression Illness	Prof Simon Mitchell
1500-1510	Questions and Discussion	
1510-1530	Five consecutive cases of hearing loss associated with inner ear barotrauma from diving successfully treated with hyperbaric oxygen	Prof David Smart
1530-1600	Full-face snorkel masks increase incidence of hypoxaemia and hypercapnia	Dr Hanna van Waart
Break 1600-1630		
Session 2 (Free Papers)		
Chair: Dr Bridget Devaney		
1630-1700	Snorkelling deaths 2000 to 2019	Dr John Lippmann
1700-1720	Hyperbaric services in Fiji	Dr Akuila Waqanicakau
1720-1810	SPUMS AGM & Diploma Presentation Ceremony	
1810-1830	SPUMS ASM 2025 Bali Information	

SPUMS ASM 2024 Programme at a glance

Thursday 16th May 2024		
Session 1		
Chair: Prof Simon Mitchell		
Time	**Talk Title**	**Speaker**
1400-1500	Immersion Pulmonary Oedema- Overview	Dr Peter Wilmshurst
1500-1515	Questions and Discussion	
1515-1530	Immersion Pulmonary Oedema Case report	Dr Sarah Lockley
1530-1545	Experiences on managing diving injuries in Lautoka Hospital	Dr Raymond Vuniwa
1545-1600	Experiences of managing diving injuries in Colonial War Memorial Hospital Emergency Department	Dr Saula Tunisau
Break 1600-1630		
Session 2		
Panel: David Smart, Simon Mitchell, Peter Wilmshurst, Neil Banham, Mark Turner		
1630-1800	SPUMS / UKSDMC Immersion Pulmonary Oedema and Diving JPS	
1800-1830	SPUMS Immersion Pulmonary Oedema Patient Information e-brochure for consensus	Dr Elisabete da Silva

Friday 17th May 2024		
Session 1 (Free Papers)		
Chair: Dr Lizzie Elliott		
Time	**Talk Title**	**Speaker**
1400-1430	Evaluation of clinical outcomes of HBOT among patients at Colonial War Memorial Hospital	Dr Katarina Mocelekaleka
1430-1500	Controlled exposure to hypoxia enhances subsequent hypoxia awareness in divers	Dr Xavier Vrijdag
1500-1600	Update on Commercial Diving	Dr Phil Bryson
Break 1600-1630		
Session 2 (Free Papers)		
Chair: Dr Sarah Lockley		
1630-1700	Free diving cases	Dr Andrew Waring
1700-1730	SPUMS ASM – The way we were	Dr Cathy Meehan
1730-1810	Shark attacks on divers in Australia	Dr John Lippmann
Close		
1900-late	Conference Dinner – Fiji Theme!	

Welcome from the Conference Convenor

Clinical Professor David Smart, AM
Immediate Past-President SPUMS and SPUMS Executive Committee member
BMedSci, MBBS(Hons-1), MD(UTas), FACEM, FIFEM, FAICD, FACTM, FUHM, Dip DHM, ANZCA Dip Adv DHM

Tasmanian born; David has logged over 3500 hours underwater since scuba training in 1981. He recently retired after nearly 4 decades of medical hospital practice and has always been active in Diving and Hyperbaric Medicine. He completed his SPUMS Dip DHM in 1989 and FACEM in Emergency Medicine in 1991. After time in SA and WA, he returned to Hobart,

was Director of Emergency Medicine at RHH 1994 – 1998. In 1998, he changed roles to half time Director of Diving and Hyperbaric Medicine at RHH, and half time Director of Calvary Hobart Emergency Department. He completed his MD with UTas in 2005 studying carbon monoxide poisoning. David has been medical consultant to various professional diving industry organisations; Chair of the ACEM scientific committee, ACEM Censor, Councillor and examiner, Chair of the ANZCA Exam Committee in Diving and Hyperbaric Medicine; including being a DHM examiner with ANZCA since 2003. He retired last year from his role as lead DHM examiner. In addition, he has been Chair of SPUMS ANZHMG; SPUMS Education Officer and President and SPUMS Australian Standards representative. He has taught at all of Australia's short courses in Diving and Hyperbaric Medicine. He has published over 150 peer reviewed papers and abstracts and received multiple national and international awards. David has previously convened SPUMS Annual Scientific meetings in 2009 (Vanuatu) and 2023 (Cairns), as well as convened a number of Emergency Medicine national meetings. In 2019 he was awarded Member of the Order of Australia (AM) for his services to Diving and Hyperbaric Medicine and Professional Organisations. He still consults on a part-time basis the diving industry and teaches at various courses.

Welcome from the Conference Scientific Convenor

Dr Neil Banham MBBS, FACEM, DipDHM, ANZCA DipAdvDHM

SPUMS President

Bula!

On behalf of the South Pacific Underwater Medicine Society, I welcome you to The Pearl Resort Pacific Harbour Fiji for our 2024 Annual Scientific Meeting.

I extend my gratitude to all delegates and speakers for their support of the conference.

The scientific program will be stimulating and diverse!

Dr Peter Wilmshurst, Cardiologist is our Keynote Speaker. Peter has a wealth of experience in the diagnosis and repair of Patent Foramen Ovale (PFO) in divers and was one of the first to publish the link between the presence of PFO being associated with an increased risk of Decompression Sickness. Peter also published the first report on Immersion Pulmonary Oedema (IPO), a topic which is becoming more topical of late and to which we will devote a session of the Conference.

Professor Simon Mitchell, Editor of our journal *Diving and Hyperbaric Medicine* will present "Update on Decompression Illness".

Dr John Lippmann from the Australasian Diving Safety Foundation (ADSF) will be presenting "Snorkelling deaths 2000-2019" and "Shark attacks on divers in Australia" (not Fiji!). John and ADSF have been great supporters of SPUMS, including funding new SPUMS Diplomates to attend our ASM to present their theses and I sincerely thank them for their ongoing support of our organisation.

During the week there will be a panel discussion to update the 2015 SPUMS / United Kingdom Sports Diving Medical Committee (UKSDMC) Position Statement on PFO and diving and a forum to attempt to define a Position Statement on IPO and return to diving. Along with these 2 sessions, we will also have the opportunity to develop consensus for diver information e-brochures on PFO and IPO and return to diving.

It will be a fabulous week!

The Australasian Diving Safety Foundation

The *Australasian Diving Safety Foundation* (ADSF) is an Australian-based Health Promotion Charity. The main object of the Foundation is to "promote the prevention and control of diving-related diseases and illnesses in human beings, including but not limited to decompression illness."

The ADSF supports its objects predominantly by undertaking research, providing education on diving safety, and offering ***grants*** *for relevant research, diving safety promotions, dive medical training, oxygen equipment and AEDs.*

The ADSF supports SPUMS in a variety of ways, which have included funding its new website, regular support for the Diving & Hyperbaric Medicine Journal, providing funding for the online posting of back issues of the journal, and scholarships to encourage recent SPUMS Diploma graduates to present their research at the Annual Scientific Meeting.

Funds have been allocated to support up to AUD$150,000 per year for appropriate research projects. In addition, the ADSF offers grants of up to AUD$20,000 to fund safety- related projects within the diving industry. Full details of these grants, as well as applications are available at http://adsf.org.au.

Included meals- Mantarae Restaurant

Breakfast- included with accommodation

Registrant lunches: Monday-Friday

Four “themed” buffet Dinners as a package for conference delegates and guests (Monday to Thursday)- at extra cost

SPUMS ExCom Meeting

Sunday 12th May 2024

Location: East Wing Boardroom

Start: 09:00

End: 13:00

Conference Registration

Sunday 12th May 2024

Location: Pearl Resort SPUMS Wing Reception

Start: 14:00

End: 16:00

Welcome Cocktail Function

Sunday 12th May 2024

Beer, wine, selected cocktails and canapes

Location: Adults Only pool area (weather permitting- or else in the reception lounge area of the wing accommodating SPUMS participants)

SPUMS has exclusive use of this space and the Mantarae Restaurant and Bar

Start: 18:30

End: 22:00

Entertainment: 20 minutes of Fijian Cultural entertainment

Gala Dinner

Friday 17th May 2024

Location: Civa room (Conference venue).

Start: 18:30

End: 23:00

Room plan with Table/ seating requests will be posted outside the Conference room

SOUTH PACIFIC UNDERWATER MEDICINE SOCIETY

52nd Annual Scientific Meeting

12 – 17 May 2024

Keynote Speaker: Dr Peter Wilmshurst, Cardiologist

Peter Wilmshurst and colleagues first reported paradoxical gas embolism in a diver with an atrial septal defect in 1986. That led to the recognition of the association between PFO and DCS, which was described almost simultaneously by Richard Moon and his colleagues from Duke University and Peter and his colleagues in 1989. Peter has demonstrated the link between shunt size and risk of DCS and he postulated the role of peripheral amplification of bubble emboli in aetiology of different manifestations of DCS. Peter and colleagues were the first to report PFO closure to prevent recurrence of DCS. They published the first descriptions of immersion pulmonary oedema in divers in 1981 and in surface swimmers in 1989.

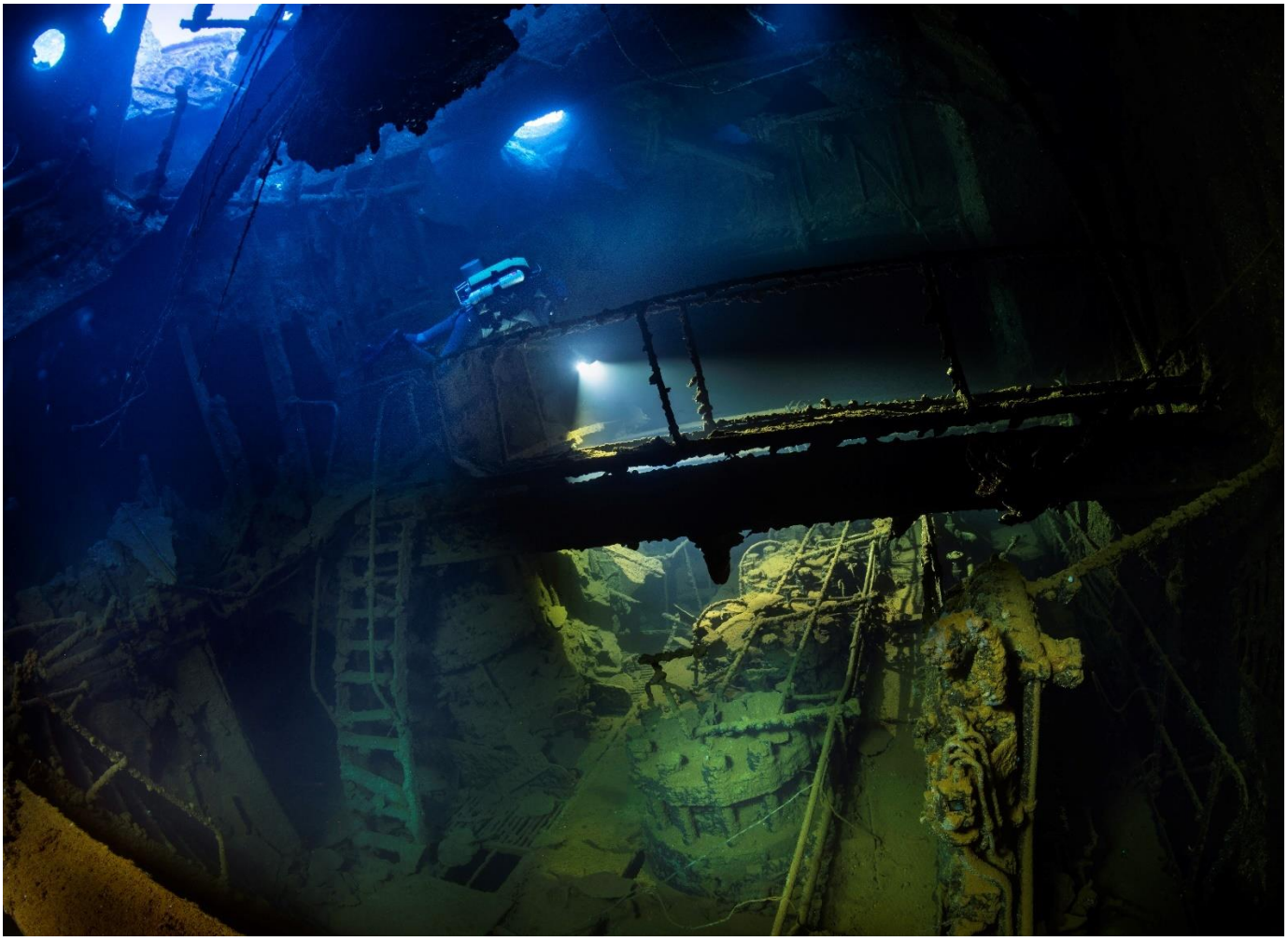
Peter graduated from Manchester University in 1974. He received post-graduate training in medicine, cardiology and intensive care in Manchester, Oxford and London, leading to MRCP 1976 and FRCP 1996. His first consultant appointment was at St Thomas' Hospital, London in 1987, later moving to Yorkshire before joint appointments in Shrewsbury and Stoke-on-Trent as a consultant cardiologist. Simultaneously he was senior lecturer in medicine at the University of Keele. Following retirement, he returned to work part-time in Stoke.

Peter has been a scuba diver since 1971. He was doctor/diver on expeditions to survey the Gulf of Eilat in the 1970s and the barrier reef of Belize in the 1980s. He has been a member of the BSAC Medical Committee since 1977, including 10 years as Chair and, at the same time, a member of the BSAC National Diving Committee. Other roles include: Treasurer of the UK Sport Diving Medical Committee and previously Chair for five years; adviser to the Health and Safety Executive on cardiology standards for diving since 1994; member of the British Thoracic Society Fitness to Dive Subcommittee 2001; consultant to NASA in 1999 (Johnson Space Center, Houston, Texas) to advise on risk of PFO during sub-atmospheric DCS.

Peter has more than 200 peer-reviewed publications and book chapters. Less than half are on diving medicine. Topics include the association between migraine with aura and right-to-left shunts, the role of hypercholesterolaemia in aortic stenosis, inheritance of congenital heart disease and cardiomyopathies, cardiac arrhythmias, and management of coronary artery disease and cardiac failure. He also has over 200 articles in diving magazines on diving illnesses and water safety and has contributed to several UK television and radio programmes on diving.

His postgraduate awards related to diving medicine are Houlder Award from the Society of Underwater Technology 1989; Jacques Yves Cousteau Award 1990; Duke of Edinburgh Prize for Sports Medicine 1991 (first recipient); Gold Medal of the Huddersfield Medical Society 1994; Sir Robert Atkins Award from the Institute of Sports Medicine 2000; Fellowship of the Institute of Sport Medicine 2001; Foundation Fellowship of the Faculty of Sport and Exercise Medicine 2006; Colin McLeod Award from the British Sub-Aqua Club Jubilee Trust 2010 and Excellence in Diving Medicine Award from the Undersea and Hyperbaric Medical Society 2020. Peter has investigated research misconduct in UK and abroad. He has given evidence before Parliament’s Health Committee and Science and Technology Committee. He has also received awards for his contribution to research integrity: HealthWatch Annual Award 2003; BMJ Editor's Award 2012 (first recipient) and Guardian of Truth and Integrity from the Brain Health Alliance 2022 (first recipient).

Invited Speaker: **Professor Simon Mitchell**



Simon works as an anaesthesiologist at Auckland City Hospital, a diving physician at North Shore Hospital (Auckland) and is Professor and Head of the Department of Anaesthesiology at the University of Auckland. He is widely published with two books and over 170 scientific journal papers or book chapters the latter including the last four editions of Harrison's Principles of Internal Medicine. In 2022 / 2023 Simon was ranked by Expertscape.com as the world's foremost expert on decompression sickness. He has received the Behnke Award (2010) and the Excellence in Diving Medicine Award (2016) from the UHMS. He has been Editor of Diving and Hyperbaric Medicine Journal since January 2019.

Simon has a long career in sport, scientific, commercial, and military diving. He has participated in cutting edge wreck and cave diving expeditions spanning many years. In 2002 he performed the deepest dive to a shipwreck at that time. In February 2023 he was a member of the Wet Mules expedition to the Pearse Resurgence cave in New Zealand where a 230 m dive was conducted using hydrogen as a breathing gas for the first time in a deep rebreather bounce dive. He was conferred Fellowship of the Explorers' Club of New York in 2006 and was the Rolex Diver of the Year in 2015.

Invited Speaker Dr John Lippmann

OAM BSc Dip Ed MAppSc PhD FUHM

John Lippmann began diving in 1971 and became an instructor 12 years later, specialising in diver rescue, first aid, oxygen administration and instructor education. He has authored or co-authored 16 books on diving safety, first aid and accident management, some of which have been published and distributed worldwide, as well as over 60 papers published in peer-reviewed medical or scientific journals. He was the founder of the Divers Alert Network Asia-Pacific (DAN AP) which he oversaw for 25 years, before establishing the Australasian Diving Safety Foundation (ADSF), an Australian Health Promotion Charity with a mission to reduce diving-related injuries and fatalities. John is an Adjunct Senior Research Fellow in the Department of Public Health and Preventative Medicine at Monash University, a Senior Research Fellow for the Royal Lifesaving Society Australia and has been made a Fellow of Undersea and Hyperbaric Medicine through the Undersea & Hyperbaric Medical Society. He has been awarded Life Membership of the South Pacific Underwater Medicine Society (SPUMS) and Life Saving Victoria.

Monday 13th May

Chair: Dr Neil Banham

1400-1405

Welcome / Bula!

1405-1500

Dr Peter Wilmshurst -Keynote Speaker

Persistent (Patent) Foramen Ovale (PFO) and diving- History and current practice

In 1944, it was reported that military aircrew with a history of migraine with “scintillating scotoma” (i.e., visual aura) had a considerably increased incidence of neurological decompression sickness (DCS) during sub-atmospheric decompression. It took many decades before we had the explanation: there are strong associations between large right-to-left shunts and migraine with aura and between large right-to-left shunts and DCS. The association with shunts applies to all clinical manifestations of DCS other than when there is joint pain. The association is particularly strong when DCS occurs after dives that have a theoretical low risk of causing DCS, but the dive profiles are capable of liberating venous bubbles. Some of those venous bubbles circumvent the pulmonary filter by passage through the shunt to reach the systemic circulation.

The right-to-left shunt may be a pulmonary (about 8%) or an atrial septal defect (about 5%), but in about 87% of cases the shunt is across a persistent foramen ovale (PFO).

About one quarter of adults have a PFO, but shunt mediated DCS usually occurs in a small minority of divers when the PFO diameter is much greater than average. PFO diameter gives some indication of the potential for right-to-left shunting but, because a PFO is a flap valve, shunting is affected by pressure differences between right and left atria, atrial filling and flow characteristics, which change from moment to moment depending on the activities after surfacing, including phase of respiration, sniffing, straining, etc.

Occurrence of DCS is partly dependent on the interaction between the timing and amount of venous bubble liberation after a dive and the degree of shunting at the time the venous bubbles enter the right atrium. Therefore, DCS might be precipitated by a relatively small number of venous bubbles if there is a very large PFO or a large amount of venous bubbles if

the PFO is moderate size. In addition, if very large amount of venous bubbles are liberated that may increase pulmonary artery pressure and hence right atrial pressure to increase right-to-left shunting. We must also factor in the person to person variability of venous bubble liberation after the same dive profile and the within person variability of venous bubbling after identical dives.

Tiny bubbles in the systemic arteries, such as result from bubble contrast echocardiography when there is a right-to-left shunt, usually produce no symptoms, except for migraine visual aura in some people. It does not cause DCS. The additional factor required for manifestations of DCS is that at the time of paradoxical bubble embolism the tissues invaded by bubbles must be supersaturated and able to amplify bubble emboli.

Therefore the assessment of a diver who has suffered DCS requires a complete history to determine manifestations of DCS, assessment of the series of dives performed in order to determine whether venous gas liberation was a possibility, bubble contrast echocardiography to detect and assess the size and type of a right-to-left shunt, and investigations to exclude other pathology that might have similar clinical manifestations, such as lung disease causing arterial gas embolism.

1500-1515

Questions and discussion

1515-1600

Dr Mark Turner

PFO closure (video)

PFO closure: practical tips and problems

1600- 1630

Afternoon tea

Session 2:

1630-1830

Chair: Dr Ian Gawthrope

Free Papers

1630-1700 Dr Bridget Devaney

Bridget is an Emergency Physician at The Alfred Hospital, in Melbourne. She is also the Medical Director of the Hyperbaric Service, and an Adjunct Research Fellow with the School of Public Health and Preventive Medicine at Monash University.

Bridget has a clinical and research interest in the interface between critical care and hyperbaric medicine. She is particularly interested in Necrotising Soft Tissue Infections, Cerebral Arterial Gas Emboli, and the care of the critically unwell patient in the hyperbaric environment.

Bridget discovered diving as a medical student in Wellington, NZ, where she worked in a dive shop on the weekends in exchange for PADI Open Water, Advanced, and Rescue dive training. Twice, she went to Egypt with grand plans to travel, and both times made it no further than the Red Sea before cancelling all travel plans, to stay put and dive. Favourite moments were dropping down the chimney to guide Bells to the Blue Hole as a Dive Master Trainee, seeing for the first time a crack in the sandy sea floor open up into the beautiful cavernous Canyon, and somewhat unforgettably, mistaking a mimic for a Cleaner Wrasse at a cleaning station (I took my regulator out of my mouth at a cleaning station...and consequently lost a small section of my tongue!).

Naturally, diving progressed to an interest in diving and hyperbaric medicine and is entirely responsible for Bridget's career trajectory.

HBOT for a patient on ECMO

A patient with severe disseminated invasive *Mucor* and *Fusarium* infection who was on extra-corporeal membrane oxygenation (ECMO) and deemed to have non-survivable disease, received a course of 13 hyperbaric oxygen treatments (HBOT) as a “last-ditch” measure.

A series of reports describe the clinical scenario, the technical considerations, and the practical, operational and governance processes that were undertaken to safely provide HBOT for this patient on ECMO.

The presentation at the 2024 SPUMS ASM provides an overview of these components.

1700-1730 Dr Jeremy Mason

Jeremy is a diving and hyperbaric medicine physician, practicing at Fiona Stanley Hospital, the State referral centre for Diving and Hyperbaric Medicine, in Perth Western Australia. He holds the SPUMS Diploma of Diving and Hyperbaric Medicine and the ANZCA Diploma of Advanced Diving and Hyperbaric Medicine. He also works as an emergency physician in public and private hospitals in Perth.

Hailing from the UK, he has worked in England, Malta and New Zealand, and completed his postgraduate training in Australia. Whilst travelling between jobs, he found himself on a remote island off Borneo, where the only activities on offer were scuba diving and Arak drinking, and not one to miss out, he indulged in both. He has since completed his Advanced Open Water dive certification. Jeremy enjoys travelling to new and exotic places to explore the underwater world, and he stopped drinking Arak before any visual damage was done!

PFO, DCI and RV dilatation

Case summary:

A 28-year-old female with 44 previous dives and no significant past medical history performed a scuba air dive to 34.9 metres for 44 minutes. There was a significant omission of her decompression obligation as per her dive computer, but no rapid ascent. She developed constitutional and neurological symptoms during the 1 hour and 48 minute surface interval, which improved at depth during her second dive to 25.7 metres for 30 minutes. Upon surfacing, she developed worsening neurological symptoms.

She was retrieved via police boat then road ambulance to Fiona Stanley Hospital and was tachycardic and tachypnoeic with a supplemental oxygen requirement. Chest Xray and bedside lung ultrasound excluded pneumothorax or pulmonary oedema. Hyperbaric oxygen treatment (HBOT) was administered via US Navy Treatment Table 6 (USN TT6) in a monoplace chamber. She improved but had ongoing limb paraesthesia and ataxia post USN TT6. MRI brain demonstrated multifocal diffusion restriction consistent with embolic infarcts. Transthoracic echocardiogram (TTE) with bubble contrast on day 3 revealed patent foramen ovale (PFO) and severe right ventricular (RV) dilation. Cardiac MRI on day 5 found a moderately dilated RV and atrium with no structural cause found. TTE on day 14 showed reduction in RV dilation, and further reduction at 3 months. Repeat cardiac MRI at 5 months showed only mild RV dilation. She was treated with 22 sessions of HBOT in total and had ongoing deficits in arm control, gait and executive cognition upon completion of treatment. She underwent PFO closure at 7 months.

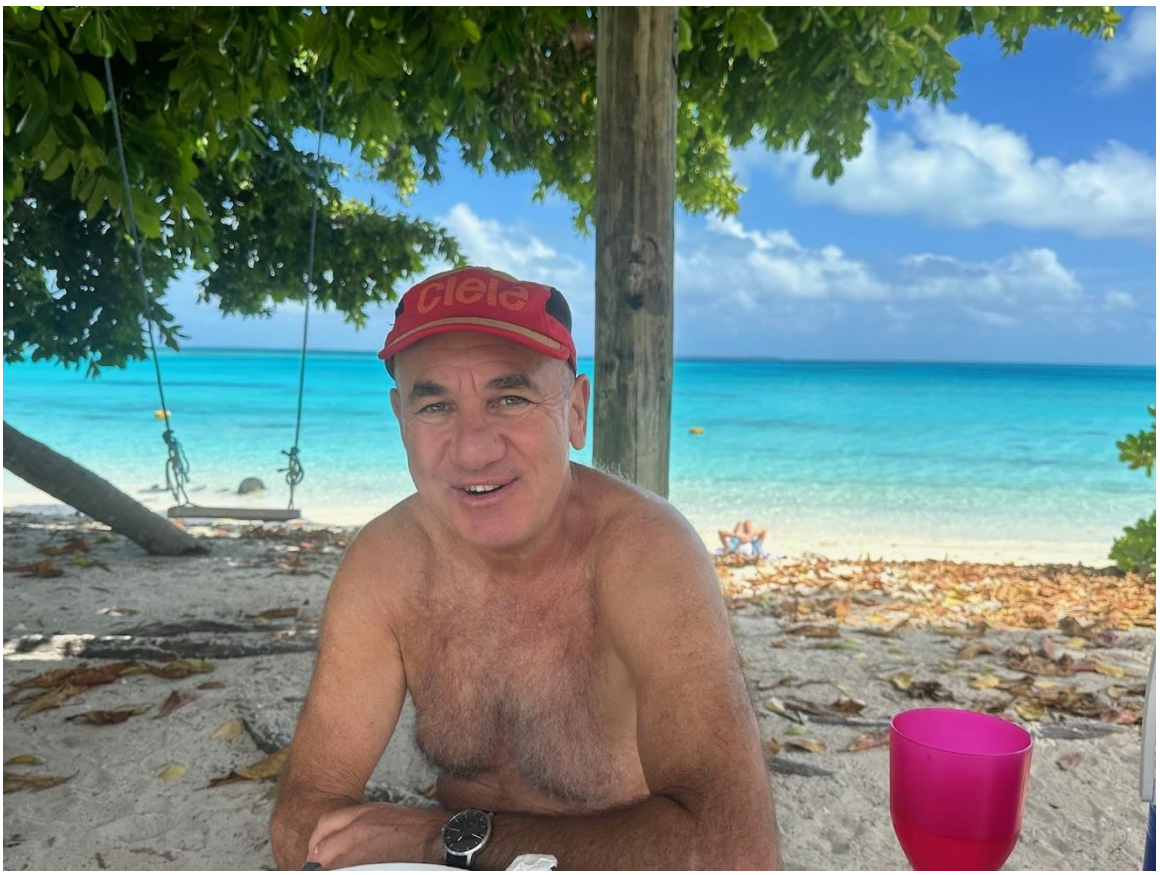
Conclusion: RV dilation was thought to be due to a transient increase in pulmonary artery pressure secondary to bubble load within the pulmonary capillary bed due to decompression sickness. This is a rarely reported phenomenon in the literature[1].

References:

1. Marabotti C, Scalzini A, Chiesa F. Increase of pulmonary arterial pressure in subjects with venous gas emboli after uncomplicated recreational SCUBA diving. Respir Med. 2013;107:596-600. doi: 10.1016/j.rmed.2013.01.002. Epub 2013 Jan 30. PMID: 23375948.

1730-1830

Dr Mark Salib



Emergency Physician FACEM FACRRM MBChB DRCOG DTM&H DA

Mark has interests in retrieval medicine, remote area medicine and wilderness medicine. He is a keen diver and has previously worked as a Divemaster in remote locations. He has spent a long career balancing tertiary hospital positions with remote area appointments such as Northern Territory RFDS and CareFlight, GP Anaesthetic DMO in Derby, Port Hedland and Carnarvon, Western Australia and ED in metropolitan Perth, Kalgoorlie and Geraldton

Sudden Cardiac Arrest- could it be you?!

Aims: To understand the reasons for sudden out of hospital cardiac arrest dispel the myth about "massive heart attack" as causation.

Methods: Evidence review
Discussion: Personal stories have driven my interest, which I will present. I welcome other opinions and experiences!

Conclusion: It’s real, it’s complicated it’s difficult to predict!

Tuesday 14th May

Chair: Prof David Smart

1400-1500

Dr Peter Wilmshurst

PFO diagnosis and management

An investigation to detect a PFO is performed if there is clinical suspicion that a person has a right-to-left shunt and that specific treatment or advice would be appropriate if a shunt is detected. The ideal test has high sensitivity and specificity, and it should be quick, inexpensive and have a low risk of complications. The evidence suggests that transthoracic echocardiography with bubble contrast injection is superior both to transcranial Doppler with bubble contrast injection and to transoesophageal echocardiography, although there are situations when these alternative techniques are appropriate.

A PFO is not the only cause of shunt-mediated decompression sickness (DCS) – about 8% of affected divers have a pulmonary shunt and about 5% have an atrial septal defect. A cardiologist, who looks for a PFO in patients who have had a stroke but who does not see divers, will be unaware of the importance of pulmonary shunting in DCS. The reason is that a single piece of thrombus can easily cross a large PFO but it will rarely cross a pulmonary shunt. In contrast, when there is a shower of microscopic venous bubbles, some will cross either a large PFO or a pulmonary shunt.

If a diver has a large PFO which puts them at risk of DCS, the options include: cessation of diving, modification of their dives (to greatly reduce the risk of venous bubble liberation and tissue nitrogen supersaturation) or to have transcatheter closure of their PFO. Divers need to know that PFO closure is not 100% successful and that there are small risks of serious complications. Success and risk are related to the experience of the operator and to the device used. The diver will need to take antiplatelet medication for a few months after the procedure. Before return to diving, the diver should have a repeat bubble contrast echocardiogram to insure that there is no significant residual shunt.

PFO closure for other clinical reasons requires considering different evidence. For example, after a stroke one must consider the degree of certainty that paradoxical thromboembolism across a PFO was responsible, patient co-morbidity and medication. If there is a possibility that the stroke was the result of paroxysmal atrial fibrillation, implanting an occlusion device

usually makes future AF ablation impossible: anticoagulation which prevents formation of both venous thrombus and left atrial appendage thrombus may be more appropriate. Anticoagulation is also required if there was definite paradoxical thromboembolism associated with massive pulmonary embolism.

1500-1515

Questions and discussion

1515-1540

Dr Sarah Lockley

Dr Sarah Lockley is a General Practitioner, working in Hobart, Tasmania, with an interest in diving and hyperbaric medicine. She is a member of the Navy Reserve and remains committed to education in Diving Medicine, with continued involvement with the Submarine Underwater Medicine Unit (including as Officer in Charge in 2009-2010) and RAN Medical Training School (2006 – 2019) and the Navy Health Reserve, since 2010. As a recreational diver, she enjoys the adventure and wonder that the underwater environment provides. She completed a Bachelor of Medical Science in 1994 at the University of Sydney and medical degree at the University of Newcastle in 2002. She completed her Fellowship with the Royal Australian College of General Practitioners in 2008 and has worked at both the Submarine Underwater Medicine Unit, and for Hyperbaric Health at their Mascot Hyperbaric Unit. Dr Lockley continues to see divers in a professional capacity in private practice in Hobart and performs recreational

and occupational diving medicals. She was a member of the Board of the Australian Diver Accreditation Scheme (2016 – 2023) and has held several positions on the Executive of the South Pacific Underwater Medicine Society as Treasurer (2017 – 2019), Secretary (2009-2010) and Assistant Treasurer.

PFO case reports

Two interesting case reports from a General Practitioner perspective, that highlight lessons learned from the previous SPUMS Annual Scientific Meeting held in 2014, where the Joint Position Statement on PFO and Diving (between SPUMS and UKSDMC) was discussed, and later published. The second case is an interesting example of how our journal and the articles within it, have a broad readership, and in this case, might have even saved a life.

1540-1600

Dr Luke Nasedra

Luke, originally from Fiji, is currently the Medical Superintendent at CWMH (Colonial War Memorial Hospital) in Fiji. He is a specialist anaesthetist, his anaesthesia attachment at the Royal Melbourne Hospital also included training in diving and hyperbaric medicine. Luke played a key role in establishing and managing hyperbaric services at CWMH from 2000 to 2018. Even after stepping down from direct management, he continues to support hyperbaric services in Fiji.

Overview of Colonial War Memorial Hospital Suva

1600- 1630

Afternoon tea

Session 2:

1630-1830

Panel: David Smart, Simon Mitchell, Peter Wilmshurst, Mark Turner, Neil Banham

1630-1800

SPUMS /UKSDMC PFO and diving JPS update

Joint position statement on persistent foramen ovale (PFO) and diving

South Pacific Underwater Medicine Society (SPUMS) and the United Kingdom Sports Diving Medical Committee (UKSDMC)
David Smart, Simon Mitchell, Peter Wilmshurst, Mark Turner and Neil Banham

Abstract

(Smart D, Mitchell S, Wilmshurst P, Turner M, Banham N. Joint position statement on persistent foramen ovale (PFO) and diving. South Pacific Underwater Medicine Society (SPUMS) and the United Kingdom Sports Diving Medical Committee (UKSDMC). *Diving and Hyperbaric Medicine*. 2015 June;45(2):129-131.)
This consensus statement is the result of a workshop at the SPUMS Annual Scientific Meeting 2014 with representatives of the UK Sports Diving Medical Committee (UKSDMC) present, and subsequent discussions including the entire UKSDMC. Right-to-left shunt across a persistent or patent foramen ovale (PFO) is a risk factor for some types of decompression illness. It was agreed that routine screening for PFO is not currently justifiable, but certain high risk sub-groups can be identified. Divers with a history of cerebral, spinal, inner-ear or cutaneous decompression illness, migraine with aura, a family history of PFO or atrial septal defect and those with other forms of congenital heart disease are considered to be at higher risk. For these individuals, screening should be considered. If screening is undertaken it should be by bubble contrast transthoracic echocardiography with provocative manoeuvres, including Valsalva release and sniffing. Appropriate quality control is important. If a shunt is present, advice should be provided by an experienced diving physician taking into account the clinical context and the size of shunt. Reduction in gas load by limiting depth, repetitive dives and avoiding lifting and straining may all be appropriate. Divers may consider transcatheter device closure of the PFO in order to return to normal diving. If transcatheter PFO closure is undertaken, repeat bubble contrast echocardiography must be performed to confirm adequate reduction or abolition of the right-to-left shunt, and the diver should have stopped taking potent anti- platelet therapy (aspirin is acceptable).

Key words
Patent foramen ovale (PFO); persistent foramen ovale; fitness to dive; decompression illness; transcatheter closure; cardiovascular; health surveillance; medical society

Introduction

This statement was produced from a workshop held at the 43rd Annual Scientific Meeting of the South Pacific Underwater Medicine Society (SPUMS) on 23 May 2014, and following consultation with the United Kingdom Sport Diving Medical Committee (UKSDMC), two members of which attended the meeting (PW and MT). The statement must be interpreted in consultation with a medical practitioner experienced in diving medicine and will be subject to review based on new evidence becoming available.

The levels of evidence defined for the position statement are those promulgated in the 2015 ACCF/AHA Clinical Practice Guideline Methodology Summit Report:[1]

Ia – Evidence from meta-analysis of randomized controlled trials;
Ib – Evidence from at least one randomized controlled trial;
IIa – Evidence from at least one well designed controlled trial which is not randomized;
IIb – Evidence from at least one well designed experimental trial;
III – Evidence from case, correlation, and comparative studies;
IV – Evidence from a panel of experts.

Each statement is followed by identification of the level of evidence in the literature for that statement and the supporting references.

Statement 1

Routine screening for persistent foramen ovale (PFO) (also referred to as 'patent' foramen ovale) at the time of dive medical fitness assessment (either initial or periodic) is not indicated (IV – consensus of SPUMS/UKSDMC).

Statement 2

Consideration should be given to investigating for PFO under any of the following circumstances:

- A history of decompression illness (DCI) with cerebral, spinal, vestibulocochlear or cutaneous manifestations (IIa);[2–8]
- A current or past history of migraine with aura (IIa);[9–15]
- A history of cryptogenic stroke (IIa); [16,17]
- A history of PFO or atrial septal defect (ASD) in a first degree relative (IIa). [18,19]

Statement 3

If screening for PFO is performed, then the following is recommended:

- That testing is undertaken by centres well practiced in the technique (IV – consensus of SPUMS/UKSDMC);
- The screening must include bubble contrast, ideally combined with trans-thoracic echocardiogram (TTE) because this best facilitates cooperation with provocation manoeuvres. Use of two-dimensional and colour-flow echocardiography without bubble contrast is not adequate (IIa);[6,7,20]
- The screening must include the use of provocation manoeuvres to promote right-to-left shunt including Valsalva release and sniffing as described in the supporting references (both undertaken when the right atrium is densely opacified by bubble contrast) (IIa).[6,7]

Statement 4

Interpreting a positive PFO screening result:

- A spontaneous shunt without provocation or a large, provoked shunt is recognized as an unequivocal risk factor for those forms of DCI listed in statement 2 (IIa);[6–8]
- Smaller shunts are associated with a lower but poorly defined risk of DCI. The significance of minor degrees of shunting needs to be interpreted in the clinical setting that led to testing (IIa).[6–8]

Statement 5

Following diagnosis of a PFO considered likely to be associated with increased DCI risk, the diver may consider the following options in consultation with a diving physician:

- Stop diving (IV – consensus of SPUMS/UKSDMC);
- Dive more conservatively: There are various strategies that might be employed to reduce the risk of significant venous bubble formation after diving, or the subsequent right-to-left shunting of such bubbles across a PFO. The appropriateness of this approach, and the strategies chosen, need to be considered on an individual basis, and in discussion with a diving medicine expert. Examples include: reducing dive times to well inside accepted no-decompression limits; restricting dive depths to less than 15 metres; performing only one dive per day; use of nitrox with air dive planning tools; intentional lengthening of a safety stop or decompression time at shallow stops; avoidance of heavy exercise and unnecessary lifting or straining for at least three hours after diving (IV – consensus of SPUMS/UKSDMC).
- Close the PFO (III).[7,11,21–24]

Statement 6

The options outlined in statement 5 require careful consideration of the risks and benefits and the clinical setting that led to screening (IV – consensus of SPUMS/UKSDMC).[24]

Statement 7

Following closure of a PFO and before returning to diving, the diver requires a repeat bubble contrast echocardiogram demonstrating shunt closure, a minimum of three months after the closure (III).[11,21,22,24]

Statement 8

Diving should not be resumed until satisfactory closure of the PFO is confirmed, and the diver has ceased potent antiplatelet medication (aspirin is acceptable) (III).[11,21,22,24]

References

This list is restricted to the original case control studies and main reports. There have been many subsequent reports of the association of PFO and cryptogenic stroke.

1 Jacobs AK, Kushner FG, Ettinger SM, Guyton RA, Anderson JL, Ohman EM, et al. ACCF/AHA clinical practice guideline methodology summit report: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. *J Am Coll Cardiol*. 2013;61:213-65. [Available from: http://www.cardiosource.org].

2 Moon RE, Camporesi EM, Kisslo JA. Patent foramen ovale and decompression sickness in divers. *Lancet*. 1989;333:513-4.

3 Wilmshurst PT, Byrne JC, Webb-Peploe MM. Relation between interatrial shunts and decompression sickness in divers. *Lancet*. 1989;334:1302-6.

4 Wilmshurst P, Davidson C, O'Connell G, Byrne C. Role of cardiorespiratory abnormalities, smoking and dive characteristics in the manifestations of neurological decompression illness. *Clin Sci*. 1994;86:297-303.

5 Germonpré P, Dendale P, Unger P, Balestra C. Patent foramen ovale and decompression sickness in sports divers. *J Appl Physiol*. 1998;84:1622-6.

6 Wilmshurst P, Bryson P. Relationship between the clinical features of neurological decompression illness and its causes. *Clin Sci* 2000;99:65-75.

7 Wilmshurst PT, Pearson MJ, Walsh KP, Morrison WL, Bryson P. Relationship between right-to-left shunts and cutaneous decompression illness. *Clin Sci*. 2001;100:539-42.

8 Cantais E, Louge P, Suppini A, Foster P, Palmier B. Right-to-left shunt and risk of decompression illness with cochleovestibular and cerebral symptoms in divers: case control study in 101 consecutive dive accidents. *Crit Care Med*. 2003;31:84-8.

9 Del Sette M, Angeli S, Leandri M, Ferriero G, Bruzzone GL, Finocchi C, et al. Migraine with aura and right-to-left shunt on transcranial Doppler; a case control study. *Cerebrovasc Dis*. 1998;8:327-30.

10 Anzola GP, Magoni M, Guindani M, Rozzini L, Dalla Volta G. Potential sources of cerebral embolism in migraine with aura. A transcranial Doppler study. *Neurology*. 1999;52:1622-5.

11 Wilmshurst PT, Nightingale S, Walsh KP, Morrison WL. Effect on migraine of closure of cardiac right-to-left shunts to prevent recurrence of decompression illness or stroke or for haemodynamic reasons. *Lancet*. 2000;356:1648-51.

12 Wilmshurst P, Nightingale S. Relationship between migraine

and cardiac and pulmonary right-to-left shunts. *Clin Sci*. 2001;100:215-20.
13 Schwerzmann M, Nedeltchev K, Lagger F, Mattle HP, Windecker S, Meier B, et al. Prevalence and size of directly detected patent foramen ovale in migraine with aura. *Neurology*. 2005;65:1415-8.
14 Wilmshurst PT, Pearson MJ, Nightingale S. Re-evaluation of the relationship between migraine and persistent foramen ovale and other right-to-left shunts. *Clin Sci*. 2005;108:365-7.
15 Wilmshurst P, Nightingale S, Pearson M, Morrison L, Walsh K. Relation of atrial shunts to migraine in patients with ischaemic stroke and peripheral emboli. *Am J Cardiol*. 2006;98:831-3.
16 Lechat P, Mas JL, Lascault G, Loron P, Theard M, Klimczac M, et al. Prevalence of patent foramen ovale in patients with stroke. *New Engl J Med*. 1988;318:1148-52.
17 Webster MWI, Chancellor AM, Smith HJ, Swift DL, Sharpe DN, Bass NM, et al. Patent foramen ovale in young stroke patients. *Lancet*. 1988;332:11-12.
18 Wilmshurst PT, Pearson MJ, Nightingale S, Walsh KP, Morrison WL. Inheritance of persistent foramen ovale and atrial septal defects and the relationship to familial migraine with aura. *Heart*. 2004;90:1315-20.
19 Wilmshurst P, Panikkar J, Pearson M, Nightingale S. Relation between inheritance of cyanotic congenital heart disease and persistent foramen ovale. *Am J Cardiol*. 2009;104:148-9.
20 Ha JW, Shin MS, Kang S. Enhanced detection of right-to-left shunt through patent foramen ovale by transthoracic contrast echocardiography using harmonic imaging. *Am J Cardiol*. 2001;87:669-71.
21 Wilmshurst P, Walsh K, Morrison L. Transcatheter occlusion of foramen ovale with a button device after neurological decompression illness in professional divers. *Lancet*. 1996;348:752-3.
22 Walsh KP, Wilmshurst PT, Morrison WL. Transcatheter closure of patent foramen ovale using the Amplatzer septal occluder to prevent recurrence of neurological decompression illness in divers. *Heart*. 1999;81:257-61.
23 Billinger M, Zbinden R, Mordasini R, Windecker S, Schwerzmann M, Meier B, et al. Patent foramen ovale closure in recreational divers: effect on decompression illness and ischaemic brain lesions during long-term follow-up. *Heart*. 2011;97:1932-7.
24 National Institute for Health and Care Excellence. *NICE interventional procedure guidance – percutaneous closure of patent foramen ovale for the secondary prevention of recurrent paradoxical embolism in divers* (IPG371 December 2010). [cited 2015 April 26]. Available from: http://www.nice.org.uk/guidance/ipg371/documents/percutaneous-closure-of-patent-foramen-ovale-for-the-secondary-prevention-of-recurrent-paradoxical-embolism-in-divers-consultation-document

Submitted: 31 October 2014
Accepted: 30 April 2015

Acknowledgements

We are grateful for the contribution of the participants at the workshop held at the 43rd Annual Scientific Meeting of the SPUMS and of the other members of the UKSDMC.

Conflicts of interest

MT acts as a consultant and proctor for St Jude Medical, Medtronic and Edwards Lifesciences, as a consultant and lecturer for Gore Medical and performs PFO closures on private patients. The other authors declare that they have no conflicts of interest.

David Smart[1], Simon Mitchell[2], Peter Wilmshurst[3], Mark Turner[4], Neil Banham[5]

[1] School of Medicine, University of Tasmania and Department of Diving and Hyperbaric Medicine, Royal Hobart Hospital, Hobart, Tasmania, Australia
[2] Department of Anaesthesiology, University of Auckland and Auckland City Hospital, Auckland, New Zealand
[3] Cardiology Department, Royal Stoke University Hospital, Stoke-on-Trent, Staffordshire, UK
[4] Bristol Heart Institute, Bristol, UK
[5] Department of Hyperbaric Medicine, Fiona Stanley Hospital, Perth, Western Australia

Address for correspondence:
Associate Professor David Smart
Department of Diving and Hyperbaric Medicine Royal
Hobart Hospital
Hobart, Tasmania 7000
Australia
Phone: *+61-(03)-6222-8193*
E-mail: *<david.smart@dhhs.tas.gov.au>*

Joint position statement on persistent (patent) foramen ovale (PFO) and diving
South Pacific Underwater Medicine Society (SPUMS) and the United Kingdom Sports Diving Medical Committee (UKSDMC)

- **Levels of evidence defined for the position statement:**

- **Ia Evidence from meta-analysis of randomised controlled trials**
- **Ib Evidence from at least one randomised controlled trial**
- **IIa Evidence from at least one well designed controlled trial which is not randomised**
- **IIb Evidence from at least one well designed experimental trial**
- **III Evidence from case, correlation, and comparative studies.**
- **IV Evidence from a panel of experts**

STATEMENT 1

- **Routine screening for persistent foramen ovale (PFO) (also referred to as 'patent' foramen ovale) at the time of dive medical fitness assessment (either initial or periodic) is not indicated. (IV- consensus of SPUMS/UKSDMC)**

STATEMENT 2

Consideration should be given to investigating for PFO under any of the following circumstances:

·A history of decompression illness (DCI) with cerebral, spinal, vestibulocochlear or cutaneous manifestations. (IIa)

·A current or past history of migraine with aura. (IIa)

·A history of cryptogenic stroke. (IIa)

·A history of PFO or ASD in a first degree relative. (IIa)

STATEMENT 3

If screening for PFO is performed, then the following is recommended:

·That testing is undertaken by centres well practiced in the technique. (IV- consensus of SPUMS/UKSDMC)

·The screening must include bubble contrast, ideally combined with trans-thoracic echocardiogram (TTE) because this best facilitates cooperation with provocation manoeuvres. Use of two dimensional and colour flow echocardiography without bubble contrast is not adequate. (IIa)

- **The screening must include the use of provocation manoeuvres to promote right-to-left shunt including Valsalva release and sniffing as described in the supporting references (both undertaken when the right atrium is densely opacified by bubble contrast). (IIa)**

- **STATEMENT 4**
- **Interpreting a positive PFO screening result:**
- **A spontaneous shunt without provocation or a large, provoked shunt is recognized as an unequivocal risk factor for those forms of DCI listed in statement 2. (IIa)**
- **Smaller shunts are associated with a lower but poorly defined risk of DCI. The significance of minor degrees of shunting needs to be interpreted in the clinical setting that led to testing. (IIa)**

STATEMENT 5

Following diagnosis of a PFO considered likely to be associated with increased DCI risk, the diver may consider the following options in consultation with a diving physician:

·Stop diving. (IV- consensus of SPUMS/UKSDMC)

·Dive more conservatively. There are various strategies that might be employed to reduce the risk of significant venous bubble formation after diving, or the subsequent right-to-left shunting of such bubbles across a PFO. The appropriateness of this approach, and the strategies chosen need to be considered on an individual basis, and in discussion with a diving medicine expert.

Examples include: reducing dive times to well inside accepted no decompression limits; restricting dive depths to less than 15 metres; performing one dive only per day; use of nitrox with air dive planning tools; intentional lengthening of safety stop or decompression time at shallow stops; and avoidance of heavy exercise and

unnecessary lifting or straining for at least 3 hours after diving. (IV- consensus of SPUMS/UKSDMC)

- **Close the PFO. (III)**

STATEMENT 6

- **The options outlined in statement 5 require careful consideration of risks and benefits and the clinical setting that led to screening. (IV- consensus of SPUMS/UKSDMC)**

STATEMENT 7

- **Following closure of a PFO and before returning to diving, the diver requires a repeat bubble contrast echocardiogram demonstrating shunt closure, a minimum of 3 months after the closure. (III)**

STATEMENT 8

- **Diving should not be resumed until satisfactory closure of the PFO is confirmed, and the diver has ceased potent antiplatelet medication (aspirin is acceptable). (III)**

Notes:

1800-1830

SPUMS PFO patient information e-brochure for consensus

Dr Eli da Silva

Dr Elisabete (Eli) Silva is a Consultant in Anaesthesia and an Advanced Trainee in Diving and Hyperbaric Medicine with ANZCA.

Her journey in this field began in 2008 when she completed her training in anaesthesia, back home in Portugal. During the final year of her training, she recognised the joy of being able to have a conversation of more than two words with patients and enrolled in the equivalent of the Fellowship in Hyperbaric and Diving Medicine back home, later becoming part of the Board of Hyperbaric and Diving Medicine Competency of the Portuguese Medical Board.

Eager for new challenges, she applied for a Registrar position in the old Hyperbaric Medicine Unit in Fremantle Hospital in 2014. Since then, it has been difficult for the Hyperbaric Medicine Units in Australia to get rid of her! She has just completed 18 months as Hyperbaric Medicine Registrar at Fiona Stanley Hospital, Perth.

Eli is currently in the process of finalising the completion of her Diploma of Advanced Diving and Hyperbaric Medicine with ANZCA.

Abstract

Aims: Assist divers in understanding the relevance of Patent Foramen Ovale (PFO) in diving related activities and its broader implications.
Assist divers in decision making regarding PFO detection with echocardiogram with bubble contrast.

Assist divers in decision making regarding PFO closure.

Methods: Search of the medical literature in the following databases: PubMed, EMBASE (OVID), and the Cochrane Central Register of Controlled Trials from January 1990 to January 2024. The search comprised vocabulary from the National Library of Medicine's Medical Subject Headings (MESH) and keywords: Patent Foramen Ovale diagnosis and Patent Foramen Ovale closure, Decompression Illness, Cryptogenic Stroke, Migraine.
Studies published in any language other than English, and non-human related were excluded.
Results: Information booklet directed to the diving community and lay persons, in plain language, with relevant and evidence-based info related to the implications of PFO detection and closure.
Discussion: Information booklet to be accessed through the South Pacific Underwater Medicine Society (SPUMS) website, and in this context to be presented for discussion and approval by SPUMS members.
Hard copy to be available during the conference, for members to review. Presentation to be divided in each of the booklet topics for individual discussion. Booklet to be updated according to relevant suggestions and corrections.

Conclusion: Information conveyed in the booklet to be updated according to the most recent Joint Position Statement on PFO and Diving from the South Pacific Underwater Medicine

Society and the United Kingdom Sports Diving Medical Committee and made freely available on the SPUMS website.

References:

1. Smart D, Mitchell S, Wilmshurst P, Turner M, Banham N. Joint position statement on persistent foramen ovale (PFO) and diving. South Pacific Underwater Medicine Society (SPUMS) and United Kingdom Sports Diving Medical Committee (UKSDMC). Diving Hyperb Med. 2015;45:129–31. PMID: 26165538.

2. Wilmshurst PT. The role of persistent foramen ovale and other shunts in decompression illness. Diving Hyperb Med. 2015;45:98–104. PMID: 26165532.

3. Denoble PJ, Holm JR, eds. Patent foramen ovale and fitness to dive consensus workshop Proceedings. Guidelines for patent foramen ovale and diving. Durham, NC, Divers Alert Network, 2015.

Wednesday 15th May

Chair: Dr Cathy Meehan

1400-1500

Professor Simon Mitchell

Update on Decompression Illness

Decompression illness (DCI) is a collective term for two diving disorders, decompression sickness (DCS) and arterial gas embolism (AGE). These disorders are related in having bubbles as the presumed primary vector of injury, potentially some symptoms in common and similar treatment protocols, but the origins of the bubbles are different and many aspects of pathophysiology and presentation are distinct. Decompression sickness is caused by bubbles formed primarily from inert gas (nitrogen in air-breathing divers) that is dissolved in tissues during a dive on which compressed gas is breathed. Arterial gas embolism is caused by pulmonary barotrauma when respired compressed gas becomes trapped in the lungs during ascent and expands as ambient pressure falls, causing damage to the pulmonary parenchyma and potentially introducing bubbles directly into the arterial circulation.

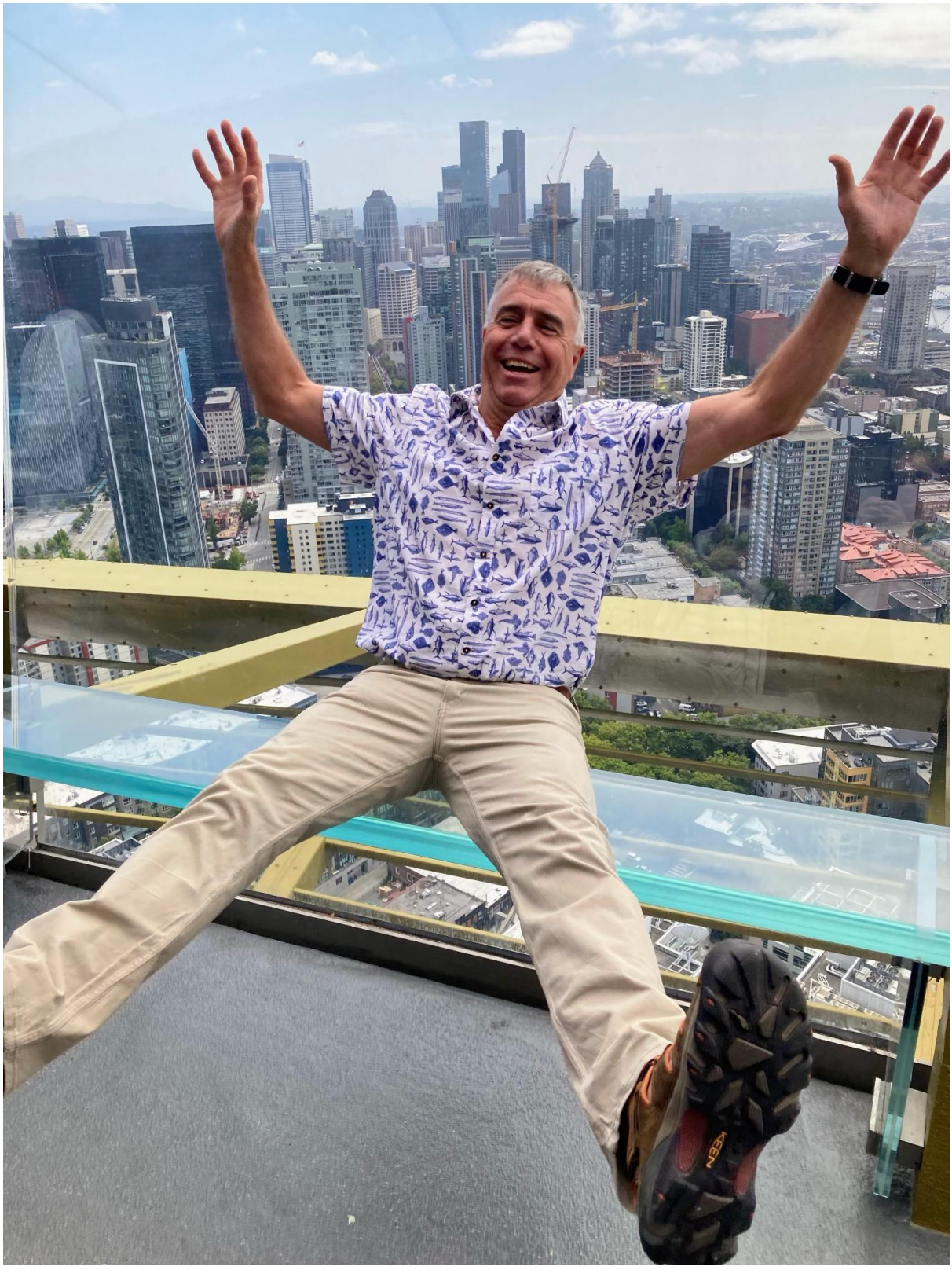
This primary focus of this presentation will be DCS, and various aspects of pathophysiology, prevention and treatment will be discussed. There will be an update on what is known about prevalence. In relation to pathophysiology, recent discoveries in relation to intra-individual variability in post-dive bubbling, and the role of microparticles will be discussed. In relation to prevention, optimisation of decompression algorithms, the use of exotic decompression gases, and approaches to personalised decompression will be described. In relation to treatment, recent advances in our knowledge of the effect of delay to recompression, treatment without recompression, and selection of recompression tables will be presented.

1500-1510

Questions and discussion

1510-1530

Prof David Smart



Tasmanian born; David has logged over 3500 hours underwater since scuba training in 1981. He recently retired after nearly 4 decades of medical practice and has always been active in Diving and Hyperbaric medicine. He completed his Dip DHM in 1989 and FACEM in Emergency Medicine in 1991. After time in SA and WA, he returned to Hobart, was Director of Emergency Medicine at RHH 1994 – 1998. In 1998, he became Director of Diving and Hyperbaric Medicine at RHH. He completed his MD with UTas in 2005 studying carbon monoxide poisoning. David has been medical consultant to various professional diving industry organisations; Chair of the ANZCA Exam Committee in Diving and Hyperbaric Medicine; including being a DHM examiner (now lead examiner) with ANZCA since 2003, Chair of the ANZHMG; SPUMS Education Officer and President; SPUMS Australian Standards representative. He has taught at all of Australia's short courses in Diving and Hyperbaric medicine. He has published over 150 peer reviewed papers and abstracts and received multiple national and international awards. In 2019 he was awarded Member of the Order of Australia (AM) for his services to Diving and Hyperbaric Medicine and Professional Organisations. He still consults on a part-time basis the diving industry.

Five consecutive cases of hearing loss associated with inner ear barotrauma from diving successfully treated with hyperbaric oxygen

Abstract

Aims:
To describe the outcomes of sensorineural hearing loss (SNHL) due to inner ear barotrauma (IEBT) in five divers treated with hyperbaric oxygen treatment (HBOT).

Methods:
The case histories of five divers presenting to the Royal Hobart Hospital Department of Diving and Hyperbaric Medicine following diving related IEBT, were reviewed. All divers provided written consent for their deidentified data to be included in the study. All had pre-injury audiograms for reference (4 occupational divers, one recreational). All divers noted ear issues during or after the dive. Post injury, independent audiologists confirmed SNHL in all 5 divers, prior to HBOT, and assessed outcomes post HBOT. This paper describes the diagnostic reasoning, HBOT regimens and outcomes, and explores pathophysiological mechanisms for HBOT.

Results:
Three divers breathed compressed air and two were breath-hold. All compressed air divers had low risk dives. None had symptoms other than hearing loss, and none had vestibular symptoms. Inner ear decompression sickness is considered unlikely for all cases. All were treated with hyperbaric oxygen, with intervals from injury to treatment ranging from less than 24 hours to 12 days. Two divers received no steroid treatment, one was treated with HBOT after an unsuccessful full course of steroids, and two divers commenced treatment with steroids 1-2 days after commencing HBO. All divers pressurised without incident. All divers

responded positively to HBOT with substantial improvements in hearing across multiple frequencies.

Table 1 summarises the clinical features, outcomes post treatment and timing of treatment.

Discussion:
The author believes this is the first case series describing use of HBOT for IEBT induced SNHL. There are some parallels with HBOT for idiopathic sudden SNHL, which is supported by level 1 evidence. The broad spread of times to treatment and also variable use/timing of steroids affects data quality, but also reflects pragmatic reality, where steroids have minimal evidence of benefit for IEBT.

Conclusion:
HBOT may benefit diving related inner ear barotrauma which has isolated sensorineural hearing loss. More study is required in this field, including data collection via a national dataset.

References:

(1) Bennett MH, Kertesz T, Perleth M, Yeung P, Lehm JP. Hyperbaric oxygen for idiopathic sudden sensorineural hearing loss and tinnitus. Cochrane Database Syst Rev. 2012 Oct 17;10:CD004739.

(2) The assessment and management of inner ear barotrauma in divers and recommendations for returning to diving. Elliott EJ, Smart DR. *Diving and Hyperbaric Medicine 2014*: 44(4) 208-22.

(3) Wei BPC, Strathopoulos D, O'Leary S. Steroids for idiopathic sudden sensorineural hearing loss. Cochrane database of Systematic Reviews. 2013 July 2;7:CD003998. DOI: 10.1002/14651858.CD003998.pub3.

Table 1. Summary of the cases

Diver	Diver Profile	Previous Audiometry	Ear clearing Issues	Initial symptoms	Evidence of vestibular dysfunction	Audiogram Post injury description	Number of frequencies affected	Hearing loss* Post injury	HBOT started	Hearing loss* post HBOT	Number of frequencies improved
1	Snorkelling under-water hockey 2.4m	Yes – normal	No	Tinnitus reduced hearing right ear	No	Downsloping SNHL	7 out of 9	43 dB	Day 8 (Steroids day 10)	8 dB	9
2	Compressed air SSBA to 18m for 5 minutes	Yes – normal	No	Tinnitus hearing loss left ear	No	Flat moderate to severe SNHL	8 out of 8	68 dB	Day 0 (Steroids day 2)	21 dB	8
3	Snorkelling < 5 metres	Yes – Bilateral loss 50dB 4-KHz	Yes	Difficulty clearing and pain in right ear	No	Flat moderate to severe SNHL	5 out of 9 4 were pre-existing	49 dB	Day 14 (Steroids 10 days prior, no benefit)	29 dB	5
4	Compressed air diving SSBA 15 metres	Yes - normal	No	Reduced hearing	No	Upsloping SNHL	8 out of 9	30 dB	Day 7 (No Steroids)	6 dB	8
5	Compressed air scuba to maximum 16 metres	Yes - normal	Yes	Pain right ear and reduced hearing, tinnitus 24H later	No	Down sloping mild SNHL	7 out of 9	19 dB	Day 12 (No Steroids)	9 dB	6

* Hearing loss was the average loss in dB for all affected frequencies compared to the non-injured ear for each diver.

1530-1600

Dr Hanna van Waart

Dr Hanna van Waart, PhD, is an Exercise Scientist from the Netherlands and currently a Senior Research Fellow at the Department of Anaesthesiology at the University of Auckland. During her PhD she specialised in epidemiology and researched the effectiveness of physical exercise during adjuvant chemotherapy at the University of Amsterdam, the Netherlands. She undertakes rebreather and diving-related research in collaboration with the Department of Exercise Sciences of the University of Auckland.

Full-face snorkel masks increase incidence of hypoxaemia and hypercapnia

Janneke Grundemann, Xavier CE Vrijdag, Nicole YE Wong, Nicholas Gant, Simon J Mitchell, Hanna van Waart

Abstract

Aims: Air flow in full-face snorkel masks (FFSMs) should be unidirectional to prevent rebreathing of exhaled air.

This study evaluated rebreathing and its consequences when using FFSMs compared to a conventional snorkel.

Methods: In a dry environment 20 participants wore three types of snorkel equipment in random order: Subea Easybreath FFSM; QingSong 180-degree panoramic FFSM; and a Beuchat Spy conventional snorkel (with nose clip), in three conditions: rest in a chair; light; and moderate intensity exercise on a cycle ergometer.

Peripheral oxygen saturation, partial pressure of carbon dioxide (pCO2) and oxygen (pO2) in the end tidal gas and FFSM eye-pockets, respiratory rate, minute ventilation, were measured continuously. Experiments were discontinued if oxygen saturation dropped below 85%, or if end-tidal CO2 exceeded 7.0 kPa.

Results: Experimental runs with the FFSMs had to be discontinued more often after exceeding 7.0 kPa end-tidal CO2 compared to a conventional snorkel e.g., 18/40 (45%) versus 4/20 (20%) during light intensity exercise, and 9/22 (41%) versus 3/16 (19%) during moderate intensity exercise. Thirteen participants exhibited peripheral oxygen saturations below 95% (nine using FFSMs and four using the conventional snorkel) and five fell below 90% (four using FFSMs and one using the conventional snorkel). The PCO2 and PO2 in the eye-pockets of the FFSMs fluctuated and were significantly higher and lower respectively than in inspired gas, which indicated rebreathing in all FFSM wearers.

Conclusion: Use of FFSMs may result in rebreathing due to non-unidirectional flow, leading to hypercapnia and hypoxaemia.

1600- 1630

Afternoon tea

Session 2:

1630-1830

Chair: Dr Bridget Devaney

1630-1700

Dr John Lippmann

Snorkelling deaths 2000-2019

Aim: To examine snorkelling and breath-hold diving fatalities in Australia from 2000 to 2019 and make some comparisons with Hawaiian snorkelling deaths.

Methods: The ADSF database and the National Coronial Information System were searched to identify snorkelling/breath-hold diving deaths from 2000 to 2019 and the extracted data were analysed.

Results: The 297 fatalities included 99 breath-hold divers. The median age was 50 years, 88% were males and two-thirds were overweight or obese. Half were overseas tourists, mostly in Queensland. Almost half had health conditions, including ischaemic heart disease (IHD) and left ventricular hypertrophy (LVH) predisposing them to an arrhythmia-related incident. At least 43% of deaths were likely from primary drowning, one quarter of these following apnoeic hypoxia. At least one-third of victims were likely disabled by cardiac arrhythmias, sometimes leading to secondary drowning. Immersion pulmonary oedema was suspected in up to 4 cases. By contrast, in Hawaii, it was reported that “probably most” of the deaths may have been caused by immersion pulmonary oedema.

Conclusions: Pre-existing health conditions, particularly cardiac disease, predispose to many snorkelling deaths in older participants and may be somewhat mitigated by targeted health screening. Drownings from apnoeic hypoxia persist in younger breath-hold divers who should avoid pushing their limits without close monitoring by a ready and capable rescuer.

1700-1720

Dr Akuila Waqanicakau

ANAESTHETIST CWM HOSPITAL, FIJI

Specialist Anaesthetist

MBBS, MMed Anaesthesia, PG Dip in Anaesthesia, Cert Diving and Hyperbaric Medicine

Dr. Akuila, originally from Fiji, serves as the Medical Officer in Charge of the Hyperbaric Unit at CWMH (Colonial War Memorial Hospital). He is a specialist anaesthetist and also completed the diving and hyperbaric medicine training in Perth, Australia, under ANZHMG. His interest in diving and hyperbaric continues by rendering services in Fiji and to smaller Pacific Island countries. Akuila is in the process of getting his open water dive certificate from PADI.

Hyperbaric Services in Fiji

1720-1810

SPUMS AGM

SPUMS Diploma presentation ceremony

Ashish Jaison

Stephan Roehr

1810-1830 SPUMS ASM 2025- Bali

Simon Mallender and Deborah Dickson-Smith (Diveplanit)

Xavier Vrijdag and Hanna van Waart (ASM 2025 Convenors)

Thursday 16th May

Chair: Prof Simon Mitchell

1400-1500

Dr Peter Wilmshurst

Immersion Pulmonary Oedema- overview

Immersion pulmonary oedema (IPO) occurs in divers and swimmers, who are asymptomatic out of the water. Affected individuals are at high risk of recurrence. IPO can be fatal and may be mistaken for drowning.

When a person is immersed up to their neck in warm water, the hydrostatic effect of water pushes blood centrally, so that cardiac filling pressures increase considerably. In addition, the immersed person breathes with continuous negative airway pressure equal to the vertical distance between the water surface and the lung centroid. The raised pulmonary capillary pressures and negative airway pressures increase the pressure gradient across the alveoli wall and set the stage for fluid transudation into the alveoli, but usually additional factors are required to precipitate frank IPO.

The best epidemiological data is from swimming activities involving large numbers of military recruits or race competitors who are all undertaking the same swim in identical conditions. These show that the incidence of IPO increases linearly with age, so that it is 13 times more frequent in those older than 60 years than those aged 18-30 years. IPO is 9 times more frequent in women than men. The reason for the sex difference is unknown. Other intrinsic risk factors include cardiac disease and hypertension. Hypertensive individuals are at greatest risk of recurrence. Extrinsic factors that increase risk are exertion, cold condition and pre-hydration before immersion.

The negative airway pressure present in swimmers may be increased by use of certain types of snorkels. In divers, the airway pressures will vary with different types of breathing equipment, the breathing gas, depth and orientation in the water.

Open-circuit scuba delivers the breathing gas at the diver's mouth at ambient pressure. So, airway pressure depends on whether the diver's regulator is above or below the level of the lung centroid. A serious problem is that if a diver using open circuit develops IPO at depth, during ascent the diver's head is above the lung centroid and respiration is with continuous negative airway pressure. This tends to worsen the IPO. In addition, the ascent causes a rapid reduction in inspired partial pressure of oxygen, so that some affected divers become unconscious during the ascent and drown.

In divers using a rebreather, the vertical distance between the counter-lung and the diver's lung centroid determines whether the diver is breathing with a negative or positive airway pressure.

Symptoms of IPO are dyspnoea, cough and expectoration of frothy sputum, which may be blood stained. Chest x-ray or lung ultrasound will confirm the diagnosis, but because swimmers and divers are prone in the water, the oedema may be predominantly over the anterior chest. Therefore, auscultation over the back of the chest may be normal when there is frank IPO.

IPO tends to improve fairly rapidly on leaving the water, but recovery is aided by use of CPAP or a PEEP device. Oxygen, vasodilating drugs and mechanical ventilation may be required.

1500-1515

Questions and discussion

1530-1545

Dr Raymond Vuniwa

ANAESTHETIST LAUTOKA HOSPITAL, FIJI

MBBS, MMed Anaesthesia, PG Dip Anaesthesia

Raymond, originally from Fiji, currently serves as an anaesthetist at Apen Medical Lautoka Hospital. He holds a Postgraduate Master's degree in Anaesthesia and has a special interest in hyperbaric and diving medicine. Raymond is working towards completing training in these fields and aims to lead the development of hyperbaric services at his hospital, furthering healthcare capabilities in Fiji.

Experiences on managing diving injuries in Lautoka Hospital

1545-1600

Dr Saula Tunisau

EMERGENCY PHYSICIAN, CWM HOSPITAL, FIJI

MBBS, PGDip in Emergency Medicine, MMED Emergency Medicine

Saula, hailing from Fiji, currently serves as an Emergency Physician at CWMH (Colonial War Memorial Hospital). He holds a Postgraduate Master's degree in Emergency Medicine and plays a vital role in the Pre-Hospital Coordination Centre (PHECC), which includes retrieval of diving injuries. Saula's expertise ensures prompt and effective care for patients in critical situations, highlighting his dedication to emergency medicine and enhancing healthcare services in Fiji.

Experiences of managing diving injuries in CWMH Emergency Department

1600- 1630

Afternoon tea

Session 2:

Panel: David Smart, Simon Mitchell, Peter Wilmshurst, Mark Turner, Neil Banham

1630-1800

SPUMS /UKSDMC IPO and diving JPS

1800-1830

SPUMS IPO patient information e-brochure for consensus

Dr Eli da Silva

Abstract
Aims: 1. Assist divers and other water sports activity enthusiasts in understanding the relevance of Immersion Pulmonary Oedema (IPO).
2. Assist divers and other water sports activity enthusiasts in decision making regarding IPO risk mitigation and prevention options.

Methods: Search of the medical literature in the following databases: PubMed, EMBASE (OVID), and the Cochrane Central Register of Controlled Trials from January 1990 to January 2024. The search comprised vocabulary from the National Library of Medicine's Medical Subject Headings (MESH) and keywords: Immersion Pulmonary Oedema diagnosis and treatment, Swimmers Pulmonary Oedema. Studies published in any language other than English, and non-human related were excluded.
Results: Information booklet directed to the diving community and lay persons, in plain language, with relevant and evidence-based information related to the implications of IPO in water sports activities and prevention options.
Discussion: Information booklet to be accessed through the South Pacific Underwater Medicine Society (SPUMS) website, and in this context to be presented for discussion and approval by SPUMS members.
Hard copy to be available during the conference, for members to review.
Presentation to be divided in each of the booklet topics for individual discussion.
Booklet to be updated according to relevant suggestions and corrections.

Conclusion: Information conveyed in the booklet to be updated and made freely available on the SPUMS website after the Joint Position Statement on IPO and

diving from the South Pacific Underwater Medicine Society and the United Kingdom Sports Diving Medical Committee.

References:

1. Wilmshurst PT, Nuri M, Crowther A, Webb-Peploe MM. Cold-induced pulmonary oedema in scuba divers and swimmers and subsequent development of hypertension. Lancet. 1989;1(8629):62-5. doi: 10.1016/s0140-6736(89)91426-8. PMID: 2562880.

Friday 17th May

Chair: Dr Lizzie Elliott

1400-1430

Dr Katarina Mocelekaleka

ANAESTHETIST CWM HOSPITAL, FIJI

MBBS, MMed 4 Anaesthesia, PG Dip in Anaesthesia

Kata, originally from Fiji, currently serves as a Senior Registrar in Anaesthesia at CWMH (Colonial War Memorial Hospital). In her final year pursuing a Masters in Anaesthesia, she has shown a keen interest in diving and hyperbaric medicine. Kata actively assists in hyperbaric services both at CWMH and across Fiji, contributing significantly to the enhancement of healthcare in the region.

Evaluation of clinical outcomes of HBOT among patients at CWMH

1430-1500 Dr Xavier Vrijdag

Xavier Vrijdag is a diving medical researcher at the Department of Anaesthesiology at the University of Auckland investigating the effects of gas narcosis in divers. He was awarded a Master's degree in Technical Medicine from the University of Twente, the Netherlands, in 2010, where he developed an algorithm to quantify cerebral arterial gas embolism in the hyperbaric environment. In 2022, he completed his Doctoral thesis on the effects of nitrous oxide, nitrogen, oxygen, and helium under pressure. Xavier has worked as a researcher and technical physician at the Department of Diving and Hyperbaric Medicine of the Academic Medical Centre, Amsterdam, the Netherlands, and as a hyperbaric technician and researcher at Deep Dive Dubai, United Arab Emirates, and is currently employed as Research Fellow at the university of Auckland, New Zealand. He is an author on 19 journal articles on the intersections of diving medicine, anaesthesiology, and neuroscience. Dr Vrijdag is a member of the Dutch Professional Association for Technical Physicians (NVvTG) and a Board Member of the South Pacific Underwater Medical Society (SPUMS). He has received over 1 million USD in funding awards and a PhD award publication from the British Journal of Sports Medicine.

Controlled exposure to hypoxia enhances subsequent hypoxia awareness in divers

Introduction:

'Rebreather' underwater breathing devices are commonly used for military, scientific and recreational diving. Malfunctions and human errors often manifest through one of the "3-H's": hypoxia, hyperoxia, and hypercapnia. Very limited research exists on enhancing the ability of divers to recognize or directly monitor the physiological manifestations of hypoxia. We conducted a two-part study examining whether prior open-label hypoxia exposure enhances a diver's ability to recognize this condition and initiate self-rescue in a subsequent blinded exposure.

Methods:
40 participants were randomised to receive either a letter describing hypoxia symptoms or to participate in an open label hypoxia exposure. Participants were monitored using pulse oximetry, fNIRS, breathing gas analysis, and other methods. At least 4 weeks later, all participants underwent a test event in which they breathed a hypoxic gas while performing a virtual reality dive. Participants were blinded to their allocation of hypoxia. The primary outcome was the proportion of participants who initiated self-rescue before reaching a peripheral oxygen saturation of 70%. Data on self-reported symptoms was collected using a visual analog scale (VAS) administered after each session.

Results:
90% of divers performed a self-initiated bailout in the hypoxia exposure group, whereas only 33% of divers did so in the information leaflet group ($p < .001$). When comparing divers in both groups, those in the hypoxia training group self-rescued at higher SpO_2 values (80% vs 69%, $p = .003$), and higher inhaled oxygen concentrations (8.8% vs 7.5%, $p = .009$). VAS data demonstrate that symptoms associated with cardiopulmonary activation (i.e., heart pounding and shortness of breath), cognitive impairment, and impaired consciousness are near-universally experienced during hypoxia exposure.

Conclusions:

These data convincingly demonstrate that divers who are exposed to hypoxia under controlled conditions are better at recognising hypoxia in the future. In addition, this study supports the existence of a “hypoxia symptom signature” that is consistent between exposures. However, these severe hypoxia exposures can only be performed under strict medical supervision.

1500-1600 Dr Phil Bryson

Dr Bryson started off his diving medicine interest at Discovery Bay in Jamaica whilst he was working in Kingston in the early days of his career. He then moved to Plymouth (UK) where he worked as a volunteer at the Diving Diseases Research Centre (DDRC) for 6 years whilst he completed his training to be a GP.

He then turned his hobby into a career and carried on working at DDRC for the next 25 years being the Medical Director there for his last 11 years, prior to leaving to take up a job at International SOS in December 2010. In 2023 TAC Healthcare took over the Aberdeen International SOS business and he is now their Medical Director of Diving Services.

He has published medical journals, sits on the DMAC, EDTC, UK Sport Diving Medical Committee and EUBS committees. He has sat on several IMCA working groups. He also is a member of the DHM Governance committee.

Update on Commercial Diving

I will look at what has been achieved in commercial diving medicine over the past 14 odd years and look at areas which we could develop. I will discuss the institutions and committees involved and the problems moving forwards.

1600- 1630

Afternoon tea

Session 2:

Chair: Dr Sarah Lockley

Dr Andrew Waring 1630-1700

MBBS FACEM DipDHM DRACOG

Primarily an emergency physician but with an interest in Hyperbaric and Diving medicine for more than 25 years. He works mostly at Fiona Stanley Hospital in Perth, Western Australia, but has worked many years in Victoria, in Derby and 2 years in the UK.

Free diving cases

Several interesting freediving cases will be presented, with audience participation encouraged!

Dr Cathy Meehan 1700-1730

MBBS; Post Graduate Diploma Med Science; Diploma Diving and Hyperbaric Medicine (DipDHM).

Catherine is a GP in Cairns, Far North Queensland, Australia. She has a special interest in diving medicine. Catherine was Secretary of SPUMS from 1993 to 2005. She is now back on ExCom as a General member and heads the Future Annual Scientific Meetings group. Catherine is an active recreational diver. She is a Dive Master, and a qualified deep cavern diver. She continues to do further training in recreational technical diving.

SPUMS ASM- the way we were…

"The Way We Were"

'Memories
Light the corners of my mind
Misty watercolor memories
Of the way we were'

A snapshot of the changes in SPUMS, through my eyes, from my first Annual Scientific Meeting (ASM) in Port Douglas in 1991, to now.

I was ambushed at my first ASM in 1991, by the late Dr John Williamson, who was the Convenor, and asked if I would agree to be nominated for the position of Secretary on the SPUMS Committee. I was Secretary for 14 years and am still a Committee member.

The changes I have seen in the Society and the ASMs since then are huge.

The advances in the technology from 1991 to now is monumental, and so the changes in the way the Committee communicates and how the ASM presentations are run is astounding.

1730-1810

Dr John Lippmann

Shark attacks on divers in Australia

Aim: The aim of this study was to identify the number, location and characteristics associated with, fatal shark attacks on divers in Australia from 1960 to 2023, inclusive.

Methods: Searches were made of (1) the Australasian Diving Safety Foundation (ADSF) Diving Mortality Database, (2) the International Shark Attack File (ISAF) website, (3) the Australian Shark Attack File (ASAF), and (4) the Global Shark Attack File (GSAF) to identify cases of fatal shark attacks on divers in Australia.

Results: There were 232 recorded attacks on divers (snorkellers, scuba and surface supplied) and these included 32 verified deaths: 16 involving snorkellers, 9 involving scuba divers, and 7 divers using surface-supply.

The victims' ages ranged from 13-50 years with a mean of 33 years. Three were females. The vast majority of attacks were from Great White Sharks.

Conclusion: Spearfishing and other seafood collection, as well as diving near fishing activities and/or seals, were identified as major risk factors. However, shark attacks on divers are relatively rare and only represent only 3% of diving-related fatalities in Australia.

1830-Close

Conference Dinner 1900-late. Fiji theme!

SPUMS
52nd ASM
Delegates

Dr	**Nasser**	AL-Hinai	Oman
RN	**Salim**	Al Mahrezi	Oman
Dr	**Ali**	Alkaabi	Abu Dhabi Emirate
Dr	**Natalie**	Aron	New Zealand
Dr	**Neil**	Banham	Western Australia
Dr	**Katie**	Brewin	Northern Territory
Dr	**Julia**	Bruce-Thompson	Queensland
Dr	**Philip**	Bryson	United Kingdom
Dr	**Rebecca**	Byrne	New South Wales
RN	**Shane**	Chand	Fiji Islands
Dr	**Tenille**	Chapman	New South Wales
Dr	**Jen**	Coleman	New South Swales
Dr.	**Craig**	Cook	Florida USA
Dr	**Helen**	Cromb	New South Wales
Dr	**Elisabete**	Da Silva	Western Australia
Dr	**Joseph**	Davey	New South Wales
Dr	**Johannes**	de Kock	South Australia
Dr	**Bridget**	Devaney	Victoria
Dr	**Amber**	Deveridge	New South Wales
Mr	**Ian**	Drysdale	United Kingdom
Dr	**Elizabeth**	Elliott	Tasmania
Dr	**Andrew**	Field	Queensland
Dr	**Renata**	Fliegner	Victoria
Dr	**Deralie**	Flower	New Zealand
Dr	**Ian**	Gawthrope	Western Australia
MS	**Katrina**	Giles	Queensland
Dr	**Steven**	Grigoleit	Victoria
Dr	**Scott**	Hahn	Queensland
Dr	**Marguerite**	Hall	Victoria
Dr	**Leonie**	Harold	Victoria
Dr	**Drew**	Heffernan	New South Wales
Dr	**Simon**	Ho	Northern Territory
Dr	**Aung**	Htay	Tasmania
Dr	**Yena**	Hwang	Queensland
Dr	**Martin**	Ibach	Western Australia
Dr	**Zaki**	Ibrahim	Northern Territory
Dr	**Ashish**	Jaison	Victoria
Dr	**Janelle**	Jamieson	Queensland
Dr	**Luke**	Jolly	Victoria
Dr	**Phillip**	Kay	Queensland

Dr	**Graeme**	Kay	Queensland
Dr	**Andrew**	Keller	New South Wales
Dr	**John**	Kenafake	Queensland
Dr	**Brett**	Kennedy	Queensland
Mr	**Rohan**	Kilby	Queensland
Dr	**Louisa**	Kippin	Queensland
Dr	**Sam**	Koch	South Australia
Dr	**David**	Kramer	Queensland
Dr	**Ray**	Lancashire	Queensland
Dr	**Michael**	Leetmaa	Denmark
Dr	**Jan**	Lehm	New South Wales
Dr	**John**	Lippmann	Victoria
Dr	**Kenneth**	Lo	New Zealand
Dr	**Sarah**	Lockley	Tasmania
Dr	**Michael**	Long	Queensland
Dr	**Jenne**	Love	Western Australia
Dr	**Geoffrey**	Macaulay	Victoria
Dr	**Caroline**	MacLeod	Queensland
Dr	**Anthony**	Maloof	New South Wales
Dr	**Catherine**	Marshall	Queensland
Dr	**Sarah**	Marshall	South Australia
Dr	**Jeremy**	Mason	Western Australia
Dr	**Alan**	McCleary	Victoria
Dr	**Helen**	McCool	Queensland
Dr	**Ian**	McWhirter	Western Australia
Dr	**Catherine**	Meehan	Queensland
Prof	**Simon**	Mitchell	New Zealand
Dr	**Katarina**	Mocelekaleka	Fiji Islands
Mr	**Wai Hang**	Mok	Hong Kong
Dr	**Taryn**	Naggs	Queensland
Dr	**Luke**	Nasedra	Fiji Islands
Dr	**Sue**	Paton	New South Wales
Dr	**Sefton**	Pene	Fiji Islands
Dr	**Raymond**	Perram	Fiji Islands
Mr	**Manuel**	Preto	Dubai
Dr	**Jodie**	Pritchard	Canada
Dr	**Yasantha**	Rajapakse	New South Wales
Dr	**John**	Richards	Queensland
Dr	**Stephan**	Roehr	Queensland
Ms	**Roxanna**	Sadri	New Zealand
RN	**Asinate**	Salabogi	Fiji Islands
Dr	**Mark**	Salib	Western Australia
Dr	**Samantha**	Saunders	Canada
Dr.	**Roxana**	Schreiber	Queensland

Dr	**Tom**	Scott	New Zealand
Prof	**David**	Smart	Tasmania
Dr	**Moira**	Somers	Western Australia
Mr	**Allan**	Standen	Queensland
Dr	**Louis**	Steyn	New South Wales
Mr	**Michael**	Tory	Queensland
Dr	**Saula**	Tunisau	Fiji Islands
Dr	**Mark**	Turner	North Somerset
Dr	**Nicky**	van der Hulst	New Zealand
Dr	**Hanna**	van Waart	New Zealand
Dr	**Jan**	Venter	New South Wales
Dr	**Eben**	Viljoen	South Australia
Dr	**Deon**	Viljoen	New South Wales
Mrs	**Linda**	Viljoen	New South Wales
Dr	**Xavier**	Vrijdag	New Zealand
Dr	**Allan**	Walley	Western Australia
DR	**Akuila**	Waqanicakau	Fiji Islands
Dr	**Andrew**	Waring	Western Australia
Dr.	**Brittany**	Weaver	Western Australia
Dr	**Craig**	Wilson	Queensland
Dr	**Rachel**	Wood	New Zealand
Dr	**Andrew**	Woollons	Queensland

OXYGEN

Too much, Too little, or just right

Present your research and learn all about oxygen toxicity, hypoxia, oxygen therapy and much more.

18 - 23 May 2025
Ramayana Resort
Bali, Indonesia

53rd Annual Scientific Meeting

SPUMS

South Pacific Underwater Medicine Society

Diveplanit Travel
Your personal dive travel agency

www.spums.au

The SPUMS 2024 Annual Scientific Meeting is approved for 19 ACEM CPD hours

CPD562_v3_Evaluation_CPD_Activity_Approval.pdf

Thanks to PADI for sponsoring our ASM drybags!

DISCOVER THE BEST UNDERWATER WORLDS WITH DIVEPLANIT

Diveplanit Travel is your Personal Dive Travel Agency.

From macro to mega, wrecks to reefs, we will create the perfect itinerary to suit your personal underwater desires and find you the best deals.

Whether that's the wrecks of Truk Lagoon or Gallipoli, the vibrant coral of Raja Ampat and the Great Barrier Reef, the macro wonders of the Philippines, PNG and Lembeh, or the pelagic action of Palau and French Polynesia.

SPUMS
South Pacific Underwater Medicine Society

Official travel partner to SPUMS.

Diveplanit
Your personal dive travel agency

Diveplanit.com
enquire@diveplanit.com
Phone: +61 7 4039 0200

The Australasian Diving Safety Foundation

The *Australasian Diving Safety Foundation* (ADSF) is an Australian-based Health Promotion Charity. The main object of the Foundation is to "promote the prevention and control of diving-related diseases and illnesses in human beings, including but not limited to decompression illness."

The ADSF supports its objects predominantly by undertaking research, providing education on diving safety, and offering ***grants*** *for relevant research, diving safety promotions, dive medical training, oxygen equipment and AEDs.*

The ADSF supports SPUMS in a variety of ways, which have included funding its new website, regular support for the Diving & Hyperbaric Medicine Journal, providing funding for the online posting of back issues of the journal, and scholarships to encourage recent SPUMS Diploma graduates to present their research at the Annual Scientific Meeting.

Funds have been allocated to support up to AUD$150,000 per year for appropriate research projects. In addition, the ADSF offers grants of up to AUD$20,000 to fund safety-related projects within the diving industry. Full details of these grants, as well as applications are available at http://adsf.org.au.