Original articles

Compressed gas diving fatalities in Australian waters 2014 to 2018

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Abstract
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Introduction: This study aimed to investigate compressed gas diving deaths in Australia from 2014–2018 and make comparison to those from 2001–2013 to identify ongoing problems and assess countermeasures.
Methods: Media reports and the National Coronial Information System were searched to identify scuba diving deaths for 2014–2018, inclusive. Data were extracted from the witness and police reports, medical histories, and autopsies. An Excel® database was created and a chain of events analysis conducted. Comparisons were made with the earlier report.
Results: Forty-two fatalities were identified, 38 using scuba and four using surface-supplied breathing apparatus involving 30 males and 12 females. The mean age of victims was 49.7 years, six years higher than the previous cohort. Fifty-four percent were obese. Six victims were unqualified, three were under instruction and at least 28 were experienced divers, significantly more than in the previous cohort. Health-related predisposing factors, predominantly obesity and cardiac-related, were identified as likely contributory to 26 incidents, and planning shortcomings to at least 22 deaths. One-third of the disabling conditions were primary drowning and one-quarter were cardiac. Three divers died subsequent to carbon monoxide poisoning and three likely from immersion pulmonary oedema.
Conclusions: Advancing age, obesity and the associated cardiac disease have become increasingly prevalent in diving fatalities and the need for appropriate assessment of fitness to dive is evident.

Introduction

Scuba diving attracts a wide cross-section of the community, from pre-teen children to the elderly, with the Professional Association of Diving Instructors (PADI) reportedly issuing one million certifications per year.[1] It is difficult to determine the number of active Australian divers, and estimates have ranged from around 85,000 to 400,000.[2,3] These estimates were based on surveys, and the wide variability results largely from the different timings, sampling procedures and sample sizes (16,000 respondents vs 1,600 respectively) and subsequent extrapolation, highlighting the difficulty of obtaining reliable activity estimates for a broad population. On the other hand, the reporting of the number of diving fatalities in Australia is relatively accurate because of routine police and coronial investigation and documentation. From 1972 to 2018 inclusive, there was an average of 8.7 scuba deaths and 1.6 surface-supplied breathing apparatus (SSBA) deaths per year.[4] A previous analysis of 126 scuba deaths from 2001–2013 highlighted the increasing age of victims, the prevalence of pre-existing medical conditions, inexperience, a poor buddy system, and failure to ditch weights in an emergency as key issues.[5] This current report investigates scuba and SSBA fatalities over the subsequent five-year period, compares these to the previous period, to determine the ongoing problems and assess countermeasures.

Methods

This represents a complete, or near-complete, case series of scuba and SSBA deaths in Australia from 1 January 2014 to 31 December 2018. For inclusion, the diver must have been reported to have been wearing a scuba set or using SSBA.

ETHICS APPROVAL

Ethics approvals for the collection and reporting of these data were received from the Victorian Department of Justice Human Research Ethics Committee to access the National Coronial Information System (NCIS; CF/21/18434).[6]

SEARCH

A comprehensive keyword search was made of the NCIS for scuba diving-related deaths throughout Australia for the period 1 January 2014 to 31 December 2018. Keywords included scuba, compressed air, and compressed gas and div*. Data obtained from the NCIS was matched with that listed on the Australasian Diving Safety Foundaton (ADSF) fatality database[4] obtained via media or word of mouth.

REVIEW PROCEDURE AND OUTCOME MEASURES

The investigator reviewed all datasets, a range of outcome measures were extracted for each case and entered into a specially created anonymised and protected Microsoft Excel® spreadsheet. Where available, these data included demographics, health factors, training and experience, the origin of victims, dive location and conditions, buddy circumstances and oversight, dive purpose and depth, equipment used and resuscitation factors.

ANALYSIS

A chain of events analysis (CEA) was performed for each case using existing templates with minor modifications.[7]

Descriptive analyses based on means and standard deviations or medians and ranges, and *t*-tests, $\chi 2$ and Mann-Whitney U tests for comparisons of age or body mass index (BMI), as appropriate, were conducted using SPSS Version 28.0.1.1 (IBM Armonk, NY; 2021). The level of statistical significance assumed was $P = 0.05$.

Results

There were 42 recorded compressed gas diving-related fatalities throughout Australia from 2014 to 2018. These comprised 38 scuba divers, two of whom were using closed circuit rebreathers (CCRs) and one individual who was doing scuba training but was not wearing a scuba unit but is included for completeness. Four divers were using SSBA (hookah). Brief summaries of the cases can be found at Appendix 1.

DEMOGRAPHICS

There were 30 male and 12 female victims. The mean (SD) age was 49.7 (11.5) years with males on average two years older than females (50.2 vs 48.5 years) ($P = 0.92$).

The mean (SD) BMI (available for 35 divers) was 29.1 (4.4) $kg{\cdot}m^{-2}$ and slightly higher for females (30.1 vs 28.7 $kg{\cdot}m^{-2}$). Nine of the victims (seven men and two women) were classified as overweight (BMI 25–29.9 $kg{\cdot}m^{-2}$), and 19 (12 men and seven women) were obese (BMI ≥ 30 $kg{\cdot}m^{-2}$).

CERTIFICATIONS AND EXPERIENCE

The level of certification was unreported in eight cases. Six of the victims were unqualified, three of these were under instruction; two undergoing open water training and one was on an introductory scuba dive. Thirteen victims held ‘open water’ (OW) certifications, five had ‘advanced open water’ (AOW) certifications, four were instructors, one a divemaster, and one a qualified commercial diver. Three divers had no experience, seven were novices (≤ 30 dives), 16 were experienced (30–199 dives), and 12 were very experienced (≥ 200 dives). Experience was unreported for four of the victims.

ORIGIN, LOCATION, SETTING AND ACTIVITY

Thirty-one of the victims were diving locally, eight were overseas tourists (seven of whom were diving in Queensland), and three were interstate tourists. Queensland and Victoria had the highest number of deaths with 11 each, followed by New South Wales and Western Australia, each with eight deaths. There were two deaths in South Australia and two in Tasmania. Twenty-seven of the deaths were in a private setting and the remaining 15 occurred in a commercial setting, including Queensland (7), New South Wales (4), Victoria (3) and Western Australia (1).

Twenty of the victims were underwater sightseeing, one in a wreck and another in a cave. Fourteen were harvesting seafood (mainly crayfish) and six deaths were associated with training or an introductory scuba experience. One death appeared to have been suicide.

The training-related deaths included a double fatality (instructor and student) who both drowned during an open water training dive, a student who suffered a heart attack after the ‘swim test’ in a pool, an OW student who likely suffered immersion pulmonary oedema (IPO) and a student who drowned while undergoing commercial dive training. One victim died after separating from their instructor in poor visibility on an introductory scuba dive.

BUDDY AND SUPERVISION CIRCUMSTANCES

Eleven victims had set out diving solo, 17 with a buddy, and 14 in a group. Fifteen divers had separated from their buddy or group before the incident, at least four of these intentionally to ascend or hunt crayfish and one to collect more scallops. Another five separated during the incident. Overall, only 11 victims were with their buddy or buddies at the time of their demise.

Twenty-two divers were under some supervision, including 12 of the 14 who were diving in a commercial setting. Six of the 12 solo divers had some supervision, from either a boat or the shore.

DEPTH AND BREATHING GAS SUPPLY

Of the 35 incidents where the dive depths were reported, more than one-third were to depths of ≤ 10 metres of seawater (msw), and two-thirds were ≤ 20 msw, with the deepest reported depth being 39 msw. At least 14 of the deaths occurred either at or very near the surface.

All the victims were breathing air, except one CCR diver who was set up for breathing oxygen but had not opened the valve. In the 32 incidents for which the remaining gas supply was reported and relevant, 28 divers had sufficient supply to reach the surface and four had exhausted their breathing gas.

EQUIPMENT TESTING AND BREATHING GAS ANALYSIS

Thirty-three reports indicated that the diver's equipment had been tested and no significant faults were found in 26 of these, other than the cylinder valves which had not been opened in two cases. Faults were reported in seven cases and included buoyancy compensator device (BCD) malfunctions, leaking regulators, torn mouthpieces, high-demand valve breathing resistance and a severed SSBA hose.

The results of a cylinder breathing gas analysis were reported in 20 cases, 15 of which met the required air purity standards.[8] However, elevated water vapour was found in three cylinders and potentially lethal levels of carbon monoxide (CO) and carbon dioxide in another.

POSITIVE BUOYANCY ATTEMPTS

Of the 34 divers who were known to be wearing a BCD, four were found with an inflated BCD, 24 divers' BCDs were not inflated, and in the other cases, the state of BCD inflation was not reported. At least 28 divers were found still wearing their weights and seven had ditched their weights. In the remainder, the weight circumstances were not reported. Only two victims were reported to have both inflated their BCDs and ditched their weights.

RESCUE AND RESUSCITATION

A rescue attempt (i.e., the victim was accessed and landed relatively quickly, with an arguable possibility of survival) was made with 27 (two-thirds) of the victims and all but one of the bodies of the remaining divers were later recovered after extended submersion periods of up to 24 hours. Water, regurgitated stomach contents and/or froth which required management was present in the airways of more than half of the rescued scuba divers. Basic life support (BLS) was attempted in 28 cases. It was not performed in other cases due to the delays in body recoveries and the absence or condition of the bodies. Not all victims who were 'rescued' received BLS, and BLS was performed on some victims whose bodies were recovered after an extended period of submersion.

An automatic external defibrillator (AED) was available on site and used by staff or bystanders (sometimes medical) in seven cases, five of which were in Queensland where they are mandated in a commercial setting. Shocks (1–4) were delivered in three cases.

CHAIN OF EVENTS ANALYSIS

Predisposing factors

Seventy-nine predisposing factors were identified in 40 of the incidents, the main ones being health-related which were identified in 26 incidents, often with multiple factors present. The most common health factors were obesity (19), ischaemic heart disease (IHD) (9), left ventricular hypertrophy (LVH) (8) and cardiomegaly (7). Alcohol intoxication directly contributed to one death and recreational drugs were possible contributors to another three. Mental health conditions were implicated in three deaths.

Planning shortcomings likely contributed to 22 fatalities, including eight where it should have been apparent that the conditions were unsuitable. Six divers set out solo, another two with intentionally loose buddy systems, and, with four divers, the incident occurred after they had intentionally separated during the dive. Other planning shortcomings included the decision to dive near fishing activities, poor suitability and positioning of SSBA equipment, and the decision to enable an untrained friend with substantial health conditions to try scuba.

Lack of training, poor skills and/or inexperience likely contributed to at least 11 deaths, three of which occurred under the supervision of an instructor, and another under a friend with no instructional certification. One of the victims was self-taught and the remainder were certified but had insufficient overall, or recent experience for the dive undertaken. At least seven of these deaths resulted in primary drowning and one in cerebral arterial gas embolism (CAGE), both of which are often associated with the inexperienced.

Equipment-related issues contributed to 10 of these deaths, the most common being leaking cylinder valves (3), overweighting (2), faulty demand valves (2), and poor SSBA air intake setups (2). Another case involved contaminated cylinder air from a poorly maintained and positioned compressor.

Inadequate supervision was identified as a factor in nine incidents. These included five instances of poor surface oversight with a variety of outcomes which included a boat reversing onto a diver, and failure to notice a hookah compressor malfunction, among others. Failures with in-water supervision by instructors were associated with three deaths.

Organisational shortcomings predisposed to at least two fatalities. One involved inadequate maintenance and

Figure 1
Likely disabling agents associated with 35 of 42 scuba fatalities; no disabling agents could be identified in seven incidents

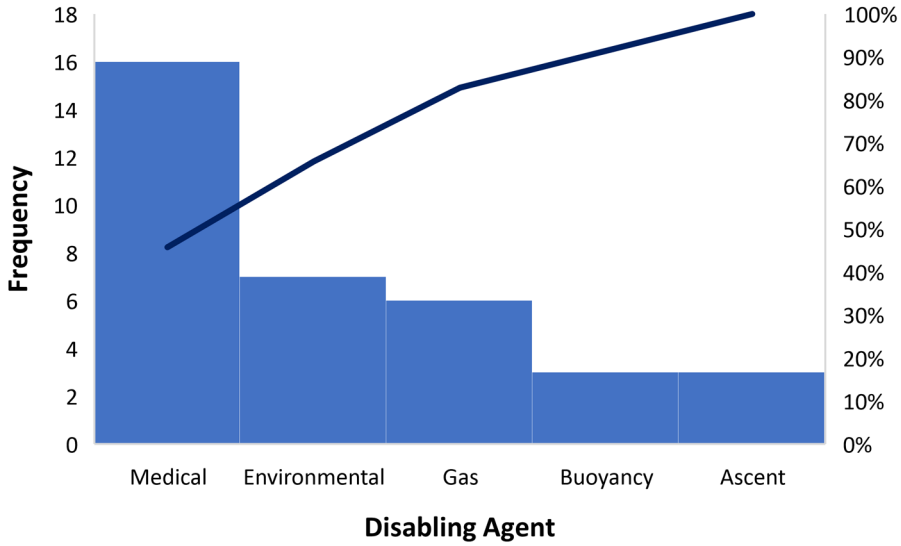
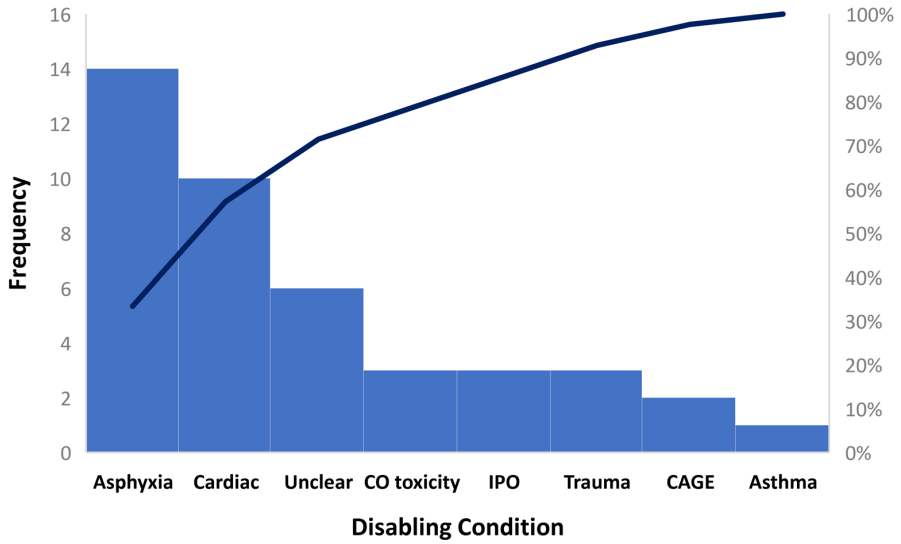


Figure 2
Disabling conditions in 42 scuba diving fatalities; CO – carbon monoxide; CAGE – cerebral arterial gas embolism; IPO – immersion pulmonary oedema



operational procedures for an air compressor, while the other involved poor dive site/conditions/ratios and selection procedures of a dive operator.

Triggers

Forty-seven likely or possible triggers were identified in 32 of the incidents. There was insufficient information to try to identify possible triggers in ten cases. The main triggers (20) were environment-related and included adverse sea conditions such as swell, chop, current and poor visibility. Eleven of the environmental triggers were believed to have been associated with the direct effects of immersion, which can impact cardiac function and lead to dysrhythmias in susceptible persons, especially when combined with other stressors such as exertion and anxiety. Exertion was thought to have been a likely trigger in at least eight cases, six of these also likely exacerbated by immersion. One case involved substantial pre-dive exertion. Five of the cases linked to exertion were in obese individuals.

Gas supply triggers were identified as likely or possible for nine incidents. These included four in which the diver had exhausted their breathing gas and two where the divers had

Table 1
Comparison of some fatality victim characteristics between the 2001–13 and 2014–18 periods

Characteristic	2001–13	2014–18	*P*
Mean age (years)	44	50	0.02
Male victims	99/126 (79%)	30/42 (71%)	NS
Overweight or obese	83/108 (77%)	28/35 (80%)	NS
Obese	40/108 (37%)	19/35 (54%)	NS
Experienced or very experienced	58/110 (53%)	28/38 (74%)	0.024
Solo	13/125 (10%)	11/42 (27%)	< 0.001
Commercial setting	58/126 (46%)	15/42 (36%)	NS
Tourist victims	35/126 (28%)	11/42 (26%)	NS
Cardiac disabling condition	32/126 (25%)	10/42 (24%)	NS

entered the water with the cylinder valve closed (one of these being diver error and the other intentional). Another two incidents were triggered by contaminated breathing gas. The final incident resulted from the loss of air supply after the displacement of a full-face mask. Two of the three trauma-related deaths resulted from adverse contact with sharks and the other with a boat.

Disabling agents

The main disabling agents appeared to have been medical factors, predominantly cardiac-related. However, IPO was the likely disabling agent in two to three cases, and asthma, aortic dissection, and seizure in one each.

Disabling conditions

The predominant disabling conditions identified were asphyxia (primary drowning), cardiac causes, carbon monoxide toxicity and immersion pulmonary oedema. In six cases, no clear disabling condition could be identified with reasonable confidence, and in two cases due to all or most of the victim's body not being recovered (Figure 2). Inexperience, poor planning, and lack of fitness/obesity were identified as predisposing factors in at least 13 of the 16 asphyxia incidents. Pre-existing medical conditions were associated with all 10 of the identified cardiac deaths with at least seven of the victims under some medical oversight. In at least two cases, the divers were not under medical care.

A comparison of some key characteristics of the fatality victims in the periods 2001–13 and 2014–18 was compiled and is shown in Table 1.

Discussion

The victims of these compressed gas diving incidents were predominantly older males who were experienced divers and many of whom were obese. There was a high prevalence of pre-existing medical conditions, mainly cardiac. Almost two-thirds of the victims were alone at the time of their incident, and most were found still wearing their weights and with uninflated BCDs. Supervision shortcomings were associated with almost one-quarter of the deaths. Two of the SSBA divers and one scuba diver died subsequent to CO poisoning.

Demographics and medical history

The victims in this series were on average almost six years older than those during 2001 to 2013, and, although there was a lower proportion of males, the difference was not statistically significant. Of interest, more than three-quarters of the divers in both series were overweight or obese with 54% of the 35 victims for whom data were available in this series being obese. Current Australian data indicate that 67% of Australian adults are reportedly overweight or obese, with the proportion who are obese being 31%. For the ages 45–54 years, which more closely reflects the scuba victims, the proportion who are obese is 37.4%.[9] This is substantially lower than the diving victims in both this and the earlier series, highlighting concerns about obesity and fitness to dive raised previously.[5,10] The prevalence of obesity increases with age which is consistent with the higher ages of victims in this series.

The Undersea and Hyperbaric Medical Society (UHMS) recommends that "*Asymptomatic candidates over 45 years of age with risk factors for coronary artery disease should undergo evaluation by a physician*."[11] However, more cautious advice from the South Pacific Underwater Medicine Society (SPUMS) is "*from the age of 45 years, all candidates should have regular assessments at no longer than five yearly intervals, with emphasis on evaluation of cardiovascular fitness and pulmonary reserves*."[12] The latter is reflected in the Australian Water Safety Strategy.[13]

In support of the recommendations for close diving medical oversight at 45 years or more, combined Australian data for 2001 to 2018 reveals that 92 (56%) of the 164 scuba victims were 45 years or older, with 84% of this subgroup likely to have suffered a cardiac-related disabling condition. Over the

extended period, at least 25% (possibly up to 30%) of all the scuba victims likely suffered a cardiac-related disabling condition.

Unfortunately, there is currently no mechanism for reviewing the fitness of certified divers. Active education by dive agencies and clubs to encourage those over 45 to seek regular review should be encouraged. Our data would suggest that any new certification on a diver over 45 years of age should have a comprehensive fitness-to-dive (FTD) assessment rather than just a questionnaire. This especially applies to those divers taking up technical diving courses that require significant physical exertion.

Seven of the victims were reported to have had medical assessments within the six months prior to their deaths, although there might have been others who were not reported. It appears that medical conditions directly contributed to the deaths of at least four of these individuals. Despite assessment guidelines, it is inevitable that some individuals with significant contraindications will be assessed as fit to dive even if a medical is conducted.[14] This can result from the candidate withholding important information (e.g., SC10 in this series – Appendix 1), a lack of diving medical knowledge by a doctor untrained in diving medicine, and, sometimes, as a result of an unsuitable candidate 'slipping through the cracks' even with a doctor with relevant training (e.g., SC25 in this series – Appendix 1). Fitness to dive assessments have some inherent limitations and the standard tests included in them will not always reveal underlying problems. Examining doctors may face the difficulty of selecting which candidates to investigate further and the most appropriate tests to conduct. A 2019 SPUMS workshop on FTD resulted in the creation of a flowchart for the screening of divers aged 45 years or more which is incorporated as an appendix in the 2020 SPUMS medical assessment form.[12,15] This tool, aimed at identifying those with a higher risk of a cardiac event, may variously include a resting 12 lead ECG, use of a cardiovascular risk calculation tool, cardiological referral, coronary artery calcium score, and exercise stress test as determined by the cardiologist in consultation with diving doctor if the cardiologist is unfamiliar with dive medicine. It is hoped that such guidelines if widely and conscientiously implemented, will reduce the number of deaths in older, often obese divers. However, regardless of age, if there is any doubt concerning a candidate's exercise capacity, these authors suggest that some form of exercise assessment should be considered along with the use of the SPUMS cardiovascular risk flowchart.

Experience

Victims in this series were generally more experienced than those in the earlier group, likely associated with their higher age. Almost all those with cardiac-related disabling conditions were classified as experienced, again highlighting the need for older divers to monitor their diving fitness. However, interestingly, most of those classified as primary drownings were also experienced, highlighting the need for experienced divers not to become complacent about what may be challenging sea conditions or when using unfamiliar equipment. As in earlier reports, lack of recent experience was also a factor in several deaths, reinforcing the potential benefit of a cautious return to diving.

Tourists and setting

There was a similar proportion of tourist victims over both periods and, although a lower proportion of deaths occurred in a commercial setting in this series, the difference was not significant. Over both periods, most of the tourist deaths occurred in Queensland which is unsurprising given the higher level of diving visitation to that State. As reported elsewhere, many of the scuba victims in Queensland are older divers, often with predisposing medical conditions.[16]

Buddy and rescue circumstances

One of the fundamental edicts of diving is to dive with a buddy, the obvious benefit being the potential for more timely assistance and rescue in the event of a problem. Solo diving has been a significant and constant feature and of concern in many fatality reports from around the world.[5,10,17–19] The relatively high number of solo divers in this series, many of whom were highly experienced, indicates a continued level of complacency. This is especially risky in the aging diver who is at a higher risk of suffering an unexpected medical episode. Additionally, the high proportion of divers who were separated from their buddies at the time of the incident once again reinforces the importance of, and the need for, improved buddy monitoring.

The low proportion of victims who had ditched weights or inflated their BCDs again suggests the lack of automaticity and the need for greater emphasis and continued reinforcement of this important self-rescue procedure. Reaching the surface generally reduces delays in rescue and the implementation of BLS. Ready access to an AED remains uncommon in the diving scenario, other than in a commercial setting in Queensland where they are mandated. With the greater prevalence of cardiac-related problems in divers, there is a need to increase the availability of AEDs at dive sites, as well as refine supervision, rescue and first aid efficiency to minimise delays to defibrillation and enhance the likelihood of successful resuscitation.[20]

Supervision

Shortcomings in supervision, whether with trainees, novices or experienced divers contributed to a number of deaths, with

Footnote: * Appendix 1 is available on DHM Journal's website: https://www.dhmjournal.com/index.php/journals?id=313

supervision failures occurring on the surface or underwater. For example, a diver on an introductory scuba experience drowned after becoming separated from the instructor in poor visibility. A student and their instructor both drowned during an open water training dive after swimming into very rough conditions. Such incidents can be mitigated through increased training and awareness of potential problems, improved planning, higher supervision-to-participant ratios, and closer monitoring.

Carbon monoxide (CO) poisoning

Although relatively common in SSBA divers,[21] CO poisoning is rarely identified in scuba divers, albeit likely underreported.[22,23] Two of the SSBA divers in this series succumbed to CO poisoning, apparently from compressor exhaust contaminating their air. One was the result of poor compressor positioning and stability, and the other from poor design with the air intake too close to the exhaust outlet, as well as poor positioning. In both cases, better supervision might have prevented the death.

The CO-related death of the scuba diver appears to be the only documented case in Australia that has been positively confirmed by both breathing gas and postmortem toxicological analysis. It resulted primarily from a combination of poor compressor placement (allowing overheating), poor maintenance, and inadequate awareness and oversight. Scuba compressors need to be installed and maintained by professionals with relevant expertise, with regular and appropriate oil and filter changes, and the air quality monitored regularly. The use of fitted and portable CO detectors would reduce the likelihood of contamination.

Immersion pulmonary oedema

There were three divers in this series who were likely victims of IPO. This assessment was based on careful consideration of the victims' diving and medical histories, witness accounts, and autopsies. A history of dyspnoea with immersion can indicate a susceptible individual, as can a medical history of hypertension or chronic cardiac pathology (e.g., mitral or aortic valve disease, IHD, myocardial fibrosis, ventricular hypertrophy).[24] Witness reports of dyspnoea, coughing (especially with expectoration of blood-stained sputum), and cyanosis can be indicative. Although these are commonly associated with drowning, in cases where there was little likelihood that the victim inhaled water, IPO may be favoured over drowning, although cardiac dysfunction also needs to be considered. The increased respiratory effort associated with faulty regulators, certain rebreathers and, possibly, some snorkels has been implicated and is a consideration.

Although prompt investigations such as blood gases, chest X-ray or CT, blood tests and echocardiography can assist with the diagnosis of IPO in survivors and may help explain the aetiology, this is far more difficult postmortem. Autopsy findings of pulmonary oedema in the airways can readily be attributed to drowning or cardiac disease. The presence of sand or other sediment in the airways, lungs or other gas spaces may sometimes help distinguish drowning from IPO. Elevated postmortem vitreous sodium chloride levels have been suggested as a diagnostic test for saltwater drowning but have limitations and should be used with caution.[25]

Based on the above criteria, Australian scuba fatality data suggest that 3.6% (6/164) of scuba fatalities from 2001–18 resulted from IPO.[14] Similarly, New Zealand data, based on the same criteria, suggest a rate of 2.1% (1/48) for 2007–16.[10] Divers Alert Network (DAN) data indicate that 2.2% of 8,348 diving-related emergency and enquiry calls to its hotline from 2014 to 2018 related to IPO.[26] However, given the diagnostic difficulties, it is believed that IPO may be underreported with many cases attributed to drowning or cardiac dysrhythmia.

Shark attacks

Both victims of fatal shark attacks in this series were diving near where others were fishing, and one was carrying a bag of scallops. Seafood collection, as well as diving near fishing activities, have been identified as major risk factors for shark attacks on divers and snorkellers.[27] Although rarely documented by investigating personnel, the use of burley to attract fish has become more prevalent and would likely increase the risk to nearby divers.

LIMITATIONS

Even using multiple sources, it is possible that some fatalities were not recorded due to limitations in recording and NCIS searches. As with any uncontrolled case series, the collection and analysis of the fatality data are subject to inevitable limitations and uncertainties associated with the investigations. Witness reports varied in their likely reliability. Police reports varied in their content, often related to the expertise of the investigators. Given that many incidents were unwitnessed, some of the assertions in the reports are speculative. Many data items were not available which rendered the study data incomplete, thus limiting the conclusions that can be drawn. The CEA attempts to identify the predominant features of each case, but there always remains an element of uncertainty.

Conclusions

Advancing age, obesity and the associated cardiac disease have become increasingly prevalent in diving fatalities, and the need for appropriate assessment of fitness to dive is evident. The high proportion of victims who were alone at the time of their incident indicates that the message of close buddy monitoring is still not getting through sufficiently. Similarly, the number of victims found still wearing their

weights and with uninflated BCDs reveals the persistence of this problem and the ongoing need to better inform divers about the importance of positive buoyancy in an emergency.

Breathing gas suppliers, whether professional, club-based, or private need to ensure that the gas supplied is free from contaminants. Users of SSBA need appropriate training to ensure they are aware of the potential hazards and the necessary measures to minimise these. Deaths from CO poisoning are usually preventable by appropriate education, equipment maintenance and/or supervision. Divers should avoid diving where there is fishing activity.

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