

SPUMS Annual Scientific Meeting 2002

A review of diving and hyperbaric medicine in Vanuatu

Robert F Grace

Key words

Recreational diving, resort diving, tourism, decompression illness, hyperbaric facilities, travel medicine

Abstract

(Grace RF. A review of diving and hyperbaric medicine in Vanuatu. *SPUMS J.* 2004; 34: 23-6.)

Many of the world’s great dive sites are located in developing countries. Vanuatu is a typical example. It is a small, developing island nation comprising 84 separate islands spanning 1000 km in the South West Pacific. Amongst these islands are fabulous coral reefs, prolific marine life and world-famous wrecks. Combine these with warm, tropical waters and Vanuatu is a paradise for scuba divers. The author has provided medical supervision for the hyperbaric chamber and been the focus for diving-related medical issues in Vanuatu since 1999. This article details experiences in diving and hyperbaric medicine in Vanuatu, including a summary of the treatment of 19 divers with decompression illness. It also highlights some of the difficulties encountered and some of the health and safety issues to be considered when visiting developing island nations.

Introduction

Vanuatu is a popular dive-holiday destination. One of Vanuatu’s best-known dive sites is the wreck of the *President Coolidge*, a deep wreck dive at Luganville, in the north of the country. The *Coolidge* was alleged to be the location of a high incidence of decompression illness. In 1999 the travel-insurance industry approached the local dive operators to discuss withdrawing insurance for divers coming to Vanuatu. The cost of flying bent divers to Australia by pressurised aircraft was proving exorbitant. The insurance industry suggested that if the dive operators could obtain a recompression chamber to treat divers in-country they would continue to provide insurance. As a result of this dialogue a chamber was procured, funded by subscriptions levied on the dive operators.

The chamber was located in Luganville close to the *Coolidge*. This created a number of logistical problems. In particular, there was an absence of medical officers with experience or interest to supervise the chamber’s operations. As a result the author began to supervise the chamber from Port Vila with an expatriate nurse experienced in hyperbaric medicine providing on-site assessment. This arrangement was far from ideal. Subsequently the managers in Luganville were no longer able to run the chamber. It also became apparent that as many divers were getting decompression illness (DCI) in Port Vila in the south as at Luganville in the North. Therefore the chamber was relocated to the capital, Port Vila.

Decompression illness (DCI) in Vanuatu

In the past four years, 37 divers have sought advice regarding the possibility of suffering from DCI. Of these, 29 (78%) were thought to have DCI. The treatment obtained by each of these divers is listed in Table 1. Note that four were flown offshore for treatment; one due to weather difficulties, and the others when the chamber was non-operational. Four divers refused any treatment.

The following information refers to the 19 divers who were treated in the chamber in Vanuatu. The mean age of the divers was 37.2 years, range 24–52. Ten were female, of whom three were menstruating at the time of their injury. Only two divers were smokers. Gastroenteritis was reported in three (16%) divers, raising the possibility of dehydration as a contributing factor. Demographic and diving details are shown in Table 2.

Table 1. Treatment received by 29 divers developing decompression illness in Vanuatu

	Number	Percentage
Hyperbaric treatment in Vanuatu chamber	19	65
Evacuation by pressurised aircraft for overseas treatment	4	14
Normobaric oxygen and intravenous fluids	2	7
Refused treatment	2	7
Refused treatment and took commercial flights home	2	7
Total	29	100

The dive histories for these 19 divers showed a fairly consistent pattern of repetitive and 'deep' diving, often with reverse profiles. The divers performed a mean of 1.8 dives per day in the period leading up to the episode of DCI. The dives undertaken were to a mean maximum depth of 32.3 meters sea water (msw). The mean depth of dives in Port Vila was 27.5 msw, while in Luganville it was 39.5 msw, reflecting the depth of the *Coolidge*. All dives were with open-circuit scuba; 16 using air and three using Nitrox mixtures. One diver performed 45 dives in 18 days, waited 20 hours before flying and developed knee pain at altitude. It is interesting to note that three divers had out-of-air situations that resulted in DCI. In all but one of the 19 cases the buddy diver suffered no illness.

One diver had a classic case of cerebral arterial gas embolism (CAGE) with loss of air supply at depth, followed by an uncontrolled ascent and loss of consciousness on the surface. The others were cases of predominantly static neuro-cutaneous or musculo-cutaneous DCI. Shoulder pain, tingling in the distal limbs, and rash were the most common manifestations of DCI (Table 3).

All the divers, including the CAGE victim, were treated with an initial Royal Navy Table 62. This was usually completed by two follow-up treatments using a Table 18:60:30 (1.5 hr, maximum pressure 280 kPa), range 0-4 follow ups. One exception was a follow-up RN Table 61. With only one exception no diver required additional recompression treatment outside of Vanuatu. The one diver who had further treatment re-presented to an Australian unit complaining of minor, residual knee pain and received a further nine treatments.

Discussion of DCI cases

It is estimated from levied funds that somewhere between 8,000 and 12,000 scuba dives are undertaken each year in Vanuatu. Twenty nine divers experiencing DCI represents an incidence of approximately 0.07%. This may be an underestimate as some divers will not report symptoms. The 2002 report on Project Dive Exploration indicated that 32,000 dives resulted in 11 divers being recompressed, equivalent to an incidence of about 0.03%.¹ The Vanuatu rate is slightly higher and this may reflect the presence of the *President Coolidge*. The incidence is also higher than those in some other holiday dive destinations such as Thailand, where an incidence of 0.02% has been reported.²

The presence of gastroenteritis in three divers raises the possibility of dehydration as a contributing factor. The frequency of gastroenteritis in DAN's 2002 review is only 4%.¹ Repetitive diving and dehydration are known to be risk factors for decompression illness. The diving patterns reported, with repetitive and deep diving, are not surprising. Most divers coming to Vanuatu for a dive holiday undertake a large number of dives in a short space of time.

Table 2. Features of divers and dives resulting in decompression illness

	Number
Medications	
Nil	6
Oestrogens or OCP	5
Anti-malarials	4
Anti-histamines	2
Anti-inflammatories	1
Diuretics	1
Health problems	
Nil	10
Gastroenteritis	3
Hypertension	2
Arthritis	2
Asthma	1
Dive planning	
Dive computer	17
Tables	3
Followed other diver	1
No gauges at all	1
Purpose of dive	
Recreational	17
Student	1
Work (freeing anchor)	1
Problems during dive	
Nil	13
Rapid ascent, out of air	3
Cold	2
Sensation of air deficit	1
Heavy exertion and out of air	1

OCP = oral contraceptive pill

Table 3. Symptoms of decompression illness reported by 19 divers in Vanuatu

Symptom	Number	Percentage
Shoulder pain	11	58
Tingling in distal limbs or digits	11	58
Rash	10	53
Headache	6	32
Muscle pains	5	26
Decreasing mental function	4	21
Knee pain	4	21
Vertigo	3	16
Nausea	3	16
Shortness of breath	3	16
Blurred vision	3	16
Tingling in face	2	11

DAN's 2002 report lists pain as the most common symptom of DCI, present in 40% of their patients, followed by paraesthesia.¹ A report from Turkey also lists the shoulder as the most common site for musculoskeletal pain in recreational divers with DCI.³ Our data are similar.

Most of the divers were keen to return home at the earliest possible opportunity and often waited only a couple of days

before flying. As a result, whenever possible, even if divers feel very good after their first couple of treatments we try to give them a further follow up. In comparison, DAN's 2002 review of recreational scuba diving injuries reports over 50% of injured divers received only one hyperbaric treatment.¹ It is interesting to note that 4 (14%) of the 29 divers presenting with DCI either refused treatment or chose to ignore advice and flew home on commercial flights. At least one of these divers developed worsening of symptoms during the flight and required oxygen.

A surprising number of divers do not carry insurance. This is a problem as treatment is expensive. It is still substantially cheaper to be treated in Vanuatu than pay for a pressurised aircraft to come and retrieve you. For divers with mild symptoms and no insurance this is a difficult decision. Many divers feel compelled to return home for a multiplicity of reasons rather than stay and be treated and are therefore inclined to risk travelling. It is difficult to be emphatic about the long-term consequences of a mild episode of DCI. Until more is known this issue will be a recurring one in remote dive locations.

Compared with most hyperbaric facilities the chamber in Vanuatu is a small operation. It comprises one multi-place chamber operated on an as-needed basis. In Vanuatu, we are often surprised by the number of follow-up treatments given to some patients overseas. One cannot help but wonder whether the high number of vested interests in these large facilities leads to a tendency to provide more treatments than might objectively be required, particularly when good, hard evidence seems to be lacking.

A number of full-time hyperbaric professionals are scathing of small, isolated chambers in remote locations. It is true there are many problems with their operation. However, in the event of serious DCI they can provide rapid treatment well in advance of the time of any retrieval aircraft. The best times to aircraft-on-the-ground in Vanuatu are in the order of 14 hours. The author is quite firmly of the opinion that if he should surface after a dive with ascending paralysis he wishes to be placed in the local chamber immediately. In Port Vila this would take about an hour in an emergency.

It is also interesting to note that in DAN's 2002 survey of 200 chambers in the United States 30% had not treated any dive-related injuries.¹ Thus, a small chamber like ours is able to offer comparatively greater experience in dealing with divers than some larger units. Further, as so many divers are travelling without insurance they are far more likely to be able to cover the costs of direct in-country recompression out of their own pocket than the cost of a pressurised aircraft and its team from Australia. The latter is at least an order of magnitude more expensive. From an economic viewpoint, if remote chambers contribute to keeping the cost of travel insurance down perhaps we are all better off in the long run?

Fitness to dive

Many people come to Vanuatu on holiday without thoughts of diving. When they arrive, resort courses and other easy opportunities to learn to scuba dive mean that a steady stream of tourists have questions regarding their fitness to dive. The most common issue is asthma. There are no facilities to perform respirometry or saline challenges in Vanuatu. These are tests that most diving medical standards require.⁴ Australian Standard AS 4005.1-2000 states that pulmonary function tests shall be conducted.⁵ We are unable to comply with this standard. Vanuatu, like most developing countries with good-quality diving, has no standards of its own on fitness to dive.⁶

Thus, the author takes a conservative approach. The difficulty arises in so called 'asthmatics' who have been free of asthma since childhood, without the need for medication for many years. These individuals have the dangers of diving with asthma explained to them. They are then left to make their own decision as to their fitness or otherwise to dive.

Other presentations for assessment have included individuals with ischaemic heart disease, diabetes and epilepsy. If at all possible anyone even vaguely considering undertaking a dive course when on holiday should seek medical advice prior to leaving their country of origin.

Miscellaneous problems

Ear problems are the most common group of non-DCI complications to arise following scuba diving. Three cases of significant ear barotrauma have presented, including bilateral tympanic membrane perforations and a possible round-window injury that was referred to Australia. Otitis externa is very common in Vanuatu. There is an audiogram facility at Vila Central Hospital. Sub-conjunctival haemorrhage, sea urchin injuries and stonefish stings are among other miscellaneous problems encountered. Questions regarding the safety of medication, particularly anti-malarials are also common. Hypoxic syncope of ascent and near drowning in a deep-water free diver required helicopter evacuation from a remote island. Two other near drownings requiring hospital admission and a case of acute myocardial infarction in a diver prior to descent are some of the other cases of diving medical interest.

Diving-related fatalities

There were six water-related fatalities during this time. One tourist drowned whilst snorkelling. This individual was resuscitated by bystanders but later declared braindead after transfer overseas. Another tourist suffered a fatal cardiac arrest on the beach immediately after snorkelling. A local snorkeller drowned while fishing, probably as a result of breath-hold diving and hypoxic syncope of ascent. Two tourists known to be poor swimmers drowned in shallow

water. One scuba diver with a history of depression may have committed suicide by diving alone at night under the influence of alcohol.

The 'real risks' on your dive holiday

Despite the emphasis on diving-related problems, people on dive holidays are far more likely to develop problems above the water than below it. Motor vehicle accidents, particularly involving motor scooters, and other trauma are a common problem. Tourists, including divers, fall off their scooter and sustain a range of different injuries far more commonly than suffering any diving-related problem. This is exacerbated in Vanuatu by the fact that we drive on the right-hand side of the road, not the left as in Australia and New Zealand where most of the tourists originate. Alcohol may play a role in the incidence of accidents. One diver sustained a life-threatening injury falling from a balcony and was lucky to survive.

There is an ever-present risk of malaria. Gastroenteritis or traveller's diarrhoea is common. There is also the risk of viral infections when exposed to a large number of new people e.g., in a hotel group. All these account for a much larger number of health-related problems than does diving per se.

Medical services in Vanuatu

Many tourists do not have a real understanding of the limited capabilities of the health services in remote locations such as Vanuatu. To be seriously ill or injured far from home is of major concern.

Vila Central Hospital is the major referral hospital for Vanuatu. Out of hours there are no medical staff in the hospital, they are available only on call. What medical staff there are come from many different cultural backgrounds. They have different standards of training and different languages all contributing to the potential for problems. Communication between staff is difficult. The hospital switchboard is ad hoc and unreliable. Out of hours the hospital switchboard will be unable to get an international telephone connection. Simple things such as blood tests and X-rays are unreliable. There is no CT scanning facility, etc. Until recently there was no hot water. Periodically the hospital runs out of basic drugs. Everything seems to take a long time, and so on.

In travelling from the airport to your hotel and then to your dive boat, it is easy to forget how low the standards of infrastructure are in locations such as Vanuatu. When diving in remote locations in the developing world, diver/tourists must put their dive site into the wider geographical context and accept this as part of the risk. Divers should carry comprehensive travel insurance at all times and ensure that their insurance covers them for their planned activities. As divers seek ever more remote locations it is worth noting that all the insurance in the world will not be able to get

you out of some places, despite what the brochure says.

Vanuatu is a beautiful place to visit and a beautiful place to dive. Diving and dive medicine in Vanuatu has its challenges but those divers and dive doctors who accept these challenges, whilst taking appropriate precautions, will not be disappointed.

References

- 1 Divers Alert Network. *Report on decompression illness, diving fatalities and Project Dive Exploration*. Durham: DAN International; 2002.
- 2 Ambriz G. Decompression illness treated in South Thailand during 1998. *SPUMS J.* 1999; 29: 230-1.
- 3 Toklu A, Aktas S, Aydin S, Çimsit M. 37 decompression sickness cases treated in the Department of Underwater and Hyperbaric Medicine, Istanbul Faculty of Medicine. *SPUMS J.* 1999; 29: 227-30.
- 4 Elliot DH. The basis for medical examination of the diver. In: Elliot DH, editor. *Medical assessment for fitness to dive*. London: Biomedical Seminars; 1995.
- 5 *Australian Standard AS 4005.1-2000 Appendix A*. Prediving medical examination for prospective recreational divers.
- 6 Walker R. Diving fitness, what GPs need to know. *Medicine Today*. 2001; Feb: 20-6.

Dr Robert F Grace, MBBS, FANZCA, FRACP, MMed, was until the end of 2003 Specialist Anaesthetist/Physician in the Department of Anaesthetics, Vila Central Hospital, Port Vila, Vanuatu.

Address for correspondence:

*C/- PO Box 432, Toowong,
Brisbane, Queensland 4066, Australia.*

E-mail: <franklyscott@hotmail.com>

The
SPUMS

web site
is at

<http://www.SPUMS.org.au>

SPUMS still needs a volunteer from the membership to take an ongoing interest in redeveloping and maintaining the SPUMS web site with the aid of a web site professional with whom negotiations are currently in progress.

Computer literacy is essential. Some web site development experience would be desirable.

Any expressions of interest should be directed to the SPUMS President, the Secretary or the Journal Office.