

weaknesses are that other risk takers are potentially excluded and that objective data may not exist so precluding quantitative advice.

The modern approach is to identify those conditions that are thought by the appropriate society to be incompatible with the activity (e.g. diving) and to prescribe against them. In diving this would include epilepsy, insulin dependent diabetes mellitus, active asthma, ischaemic heart disease etc. Otherwise the approach is to allow discretion.

Does such an approach work?

The New Zealand Occupational Diving Medical Directorate adopted this approach in 1999. Acceptance is high from:

- 1 Divers, whose replies to the questionnaire shows increased veracity.
- 2 Medical practitioners, who avoid "wasting time" on annual medicals but who might suffer a loss in income.
- 3 Employers, whose costs are reduced.

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RESTRICTED DIVING FOR THE UNFIT

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Key Words

Diving medicals, fitness to dive, medical conditions and problems, recreational diving, standards.

Definitions

We have already defined for our purposes that a person fit to dive is a person in whom no medical condition has been found that is incompatible with unrestricted diving as an amateur within the recreational envelope. A time limit upon this clearance might seem wise but is rarely given. Although the boundaries of that envelope may vary between individual divers, according to their training, physical abilities and diving skills, the hazards within this activity envelope are very similar and so the required medical standards should be the same.

It is then easy to define the category of *unfit* as everybody else.

This category includes those in the conventional category of "Disabled Diver". These are typified by those with major amputations or the wheel-chair divers who are fit to dive, other than being also challenged with probably some autonomic deficits. Their limitations can be assessed and they dive in accordance with guidelines made by one of many organisations dedicated to diving for the disabled. For the purposes of our discussion persons who have primarily physical limitations of any kind ranging from quadriplegia to hearing deficits, need no further consideration at this stage.

The unfit divers to be considered further here are those who would fail the initial self-declaration form and who then, rightly or wrongly, may be unable to get a doctor's fitness certificate for *unrestricted* recreational diving. As a whole, the medically disabled can be categorised in several ways:

CAPABLE OF INDEPENDENT UNRESTRICTED DIVING

We have already discussed that some persons with a history of asthma may be excluded from diving by some organisations but, in accordance with particular criteria, are accepted by others.

They should have a time-limited clearance but, once declared fit, need no further restrictions upon their activity.

THOSE WITH A PHYSICAL DISABILITY AND MAY BE DEPENDENT ON OTHERS IN THE WATER

The disabled diver with no medical complications.

RESTRICTED DIVING BUT NEEDING NO OTHER CONSIDERATION WHEN IN THE WATER

This group includes those who for some reason, such as previous decompression illness, have been told that they should confine themselves to diving with safer decompression schedules.

RESTRICTED DIVING BUT CONDITIONAL ON THE PRESENCE OF A SUPPORT TEAM

An example is that of the stable insulin-dependent diabetic who has met the strict medical criteria of the UK Sport Diving Medical Committee (UKSDMC) and who complies with its special procedures.

Restricted only, with no other in-water consideration

Occasionally, the restriction of a diver to only shallow diving is wrongly recommended by hospital doctors who do not know about diving. They may not understand that Boyle's Law is at its worst near the surface and that the air-water interface can be physically very challenging. Such decisions need to be made by a doctor who is familiar with the hazards of the diving environment.

Nevertheless, a restriction to shallow diving may be appropriate for some. Consider the ex-commercial diver who had a bad spinal bend with residua, but who has no functional deficits. Consider the sport diver who had an "undeserved" and very mild neurological decompression illness after a correctly followed decompression dive and who is then found to have a PFO. A shallow diving limit may be appropriate but, as will be discussed in a later presentation, there are other recommendations that might be more practical.

One might wish to consider the elderly here but, in the absence of any specific medical problem, their diving should be subject to self-imposed limitations. However, a lack of insight may need to be corrected by others.

Restricted but dependent on a support team

Occasionally a person is allowed to dive without proper medical screening, e.g. the uninitiated tourist trying his/her first diving experience. The dive is brief and is planned to be under the immediate supervision of competent divers, but the volunteer's fitness is not always known. Is this wise? No, but it happens.

An example that provides a better test of the principle of restricted diving in the presence of a support team is provided by diabetes. Again, many papers and reviews have been written but first it is worth looking at the current guidance.

Diabetes

THE UK HEALTH & SAFETY EXECUTIVE (FOR WORKING DIVERS)

"Glycosuria would require investigation. Insulin dependent diabetes mellitus or non-insulin dependent diabetes controlled by oral hypoglycaemic agents are contraindications. Non-insulin dependent diabetics treated with diet alone should be assessed on an individual basis bearing in mind the type of diving required. In such cases restricted certification should be used."

UKSDMC GUIDELINES

The UKSDMC has decided that diabetic divers may be allowed to dive provided that they are able to pass the standard UKSDMC medical examination and in addition, satisfy the following criteria:

- 1 The diabetic diver has not experienced any hypoglycaemic attack within the last year.
- 2 The diabetic diver has not been hospitalised for any reason connected with diabetes in the last year.
- 3 The physician in charge of the diver at the diabetic clinic must consider the level of control to be satisfactory. This implies that the long-term control of

the diabetic condition must be good. A guide to this may be obtained from the HbA_{1c} or fructosamine level. The physician must also be able to state that he or she considers the potential diabetic diver to be mentally and physically fit to undertake the sport of diving.

- 4 There must be no microalbuminuria present. Any degree of retinopathy beyond background retinopathy is not allowed. There must be no evidence of neuropathy (sensory, motor or autonomic), nor of vascular or microvascular disease beyond the background retinopathy in the eye.

However, besides annual re-evaluation, there are additional administrative conditions and important diving precautions that carefully restrict the diver and that together are considered to control the risk.

THE SPUMS DIVING MEDICAL

"Dip-stick test of urine shall be performed and urine tested for albumin, sugar, and blood. Glycosuria calls for investigation before acceptance. ... Diabetes requiring medication with insulin is a contraindication to diving."

THE RSTC GUIDELINES

"Absolute Contraindications"

The potentially rapid change in level of consciousness associated with hypoglycaemia in diabetics on insulin therapy or oral anti-hypoglycaemia medications can result in drowning. Diving is therefore contraindicated."

So, what restrictions should there be?

No diabetic diver, whether diet-controlled, tablet-controlled or insulin-controlled should dive without proper assessment. Modern thinking about diabetes recognises that, whilst those who take insulin or oral hypoglycaemics to control their diabetes are the divers who are at risk of becoming hypoglycaemic underwater, ALL DIVERS WHO ARE DIABETIC have an increased risk when diving due to the long-term complications of diabetes.

These complications may affect the diver underwater (such as cardiac disease) or may lead to complications at the surface (such as peripheral neuropathy when considering whether a diver is suffering from decompression illness).

It is agreed that only diabetics controlled by diet alone should be considered fit for unrestricted diving and it is acknowledged by some that, with special training and diabetic management procedures, selected individuals with insulin -dependent diabetes can be allowed to dive under specified conditions. Note that those on oral medication who become hypoglycaemic may be more difficult to manage than those who become so on insulin.

The UKSDMC advises diabetic divers to dive only once or twice each day and generally not to dive more than three days consecutively.¹ It is helpful both to the diabetic diver and to the club to which the diver belongs that the diabetic should give an annual lecture to the club on the problems of diabetes and diving. They must also give a demonstration of how they administer glucose to themselves and how they monitor their blood glucose. Pre-dive, the diving diabetic should be as fit and mentally prepared to dive as any non-diabetic diver. They should preferably be wearing a bracelet to state that they are both a diabetic and a diver, and that the possibility of decompression illness should also be considered. The dive marshal for the dive should be aware that the diver is diabetic and should be informed of the profile of the proposed dive. The diabetic diver's buddy should be their regular diving partner and familiar with the diabetic's individual problem. Alternatively, the buddy should be a trained medic or paramedic who understands diabetes. The buddy must not be a diabetic. Additionally, most divers will take with them a small kit, containing either oral glucose tablets or preferably oral glucose paste. The other items of equipment include an emergency intramuscular injection of glucagon, also glucose testing sticks together with the necessary kit and instructions for the use of such testing kit. The normal diver safety equipment should be carried with one or more of the following items: surface marker buoy, flag, personal flares and/or an emergency beacon. Diabetics should plan to carry their glucose tablets or a tube of glucose paste with them in a small waterproof bag during the dive. The diving buddy must know the whereabouts of these and be able to administer these and, if necessary, be able to administer the intramuscular injection of glucagon once on dry land. Adequate hydration of the diabetic is also essential and, before diving, diabetics should take extra glucose to ensure they have a higher blood level.

The UKSDMC states that a diabetic diver should not dive deeper than 30 m. Hypoglycaemia could be indistinguishable from nitrogen narcosis. He or she should remain well within the tables and have more than two minutes no-stop time left on any dive computer. On return to the boat or shore after a dive the diabetic should check his or her glucose level and correct it in the appropriate manner. The UKSDMC also says that any adverse symptoms or signs should be reported immediately to the diving buddy or dive marshal. Nothing should be passed off as "part of diving". The diving officer and all concerned must recognise that the symptoms of low blood sugar may mimic those of neurological decompression illness. In this situation first aid therapy should be given as though both conditions are present i.e. 100% oxygen and treatment for low blood sugar. In the case of an unconscious diabetic diver the blood glucose level should be quickly measured using the diabetic person's glucometer.

As of November 1999, a study currently being conducted by the Diving Diseases Research Centre

(Plymouth, UK) had deposited data into a database from 230 diabetic divers (190 males, 40 females). The age range of the divers was 19-69, with 10.4% having non-insulin dependent diabetes mellitus (NIDDM). The total number of dives logged by them was 5,348, with one diabetic diver logging more than 1,200 dives. Over this period from 1991, 83 divers have ceased diving for a variety of reasons, but none of them has reported having problems associated with diabetes while diving. The deepest dive recorded in the series is to 40 m. Eleven respondents had episodes of hypoglycaemia in the past year. Manual investigation of these records (which included telephoning each of the 83 divers who had ceased diving) established that 7 of the hypoglycaemic attacks were not in any way diving related. Three divers had had diving incidents of a non-medical nature and one had had a mild hypoglycaemic attack underwater that was successfully managed.

Conclusions

Of the four categories of fitness for recreational diving for those who have some relative contraindication, those who require of competent support team will have more difficulty in arranging to undertake a modest dive than those with other types of unfitness.

- 1 Those divers with conditions such as asthma may either be fit for independent unrestricted diving, at least while they remain stable, or they are not fit at all. These divers have no medical restrictions once they get in the water.
- 2 Those with a physical disability but with no medical complications, represent the conventional disabled diver. They may be dependent on others in the water to a greater or lesser degree but their assessment is straightforward and so should present no major medical problems.
- 3 Those who should confine themselves, for instance, to shallow diving would tend to be following self-imposed restrictions. Provided that the underlying reason for this is not incompatible with diving, they should be able to dive as competently as those who are unrestricted.
- 4 Those divers whose diving is dependent on the presence of a support team with some medical responsibilities are probably confined to diving within a club structure. In the case of diabetic divers, there is greater awareness of their needs as a result of programs such as the one mentioned above, and more dive centres throughout the world are prepared to accept these divers into their community.

Reference

- 1 Edge CJ. The diabetic diver. In *Medical assessment of fitness to dive*. Elliott DH. Ed. London: Biomedical Seminars, 1995: 59-61

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DIABETES AS A CONTRAINDICATION TO DIVING: SHOULD OLD DOGMA GIVE WAY TO NEW EVIDENCE?

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Key Words

Diabetes, drugs, risks, safety.

Abstract

Background

Diabetics, particularly those who require insulin, are usually considered unfit to undertake compressed gas diving. This judgement has been based on concerns over hypoglycaemic events, hypoglycaemia unawareness, increased risk of DCI and ambiguity between diabetic symptoms and those of DCI. A SPUMS "Statement" released in 1992 proscribed diving by diabetics. Since this time there has been a progressive shift from prescriptive toward discretionary diving fitness evaluations, and this has been paralleled by increasing pressure from diabetics to be "allowed" to dive. We undertook a contemporaneous review of the issue.

Methods

A review was undertaken to locate relevant material. This included a Medline search, and contact with authorities known to have an interest in the issue such as Divers Alert Network (DAN) and the British Sub-Aqua Club (BSAC).

Results

Few papers published in the indexed literature address this issue. In contrast, textbooks and popular press

diving publications contain numerous references. Few articles of any type contain relevant original data. The proscription against diving by diabetics is based largely on theoretical concerns, opinion and some case reports of diving accidents involving diabetics. In contrast, several data sets describing diving activity by diabetics suggest that some can dive at an acceptable level of risk. A voluntary DAN survey reported 48,663 dives by 110 diabetic respondents with only 1 case of DCI. Hypoglycaemia had been experienced by 15% of respondents at some time during diving, but no case had ended adversely. The BSAC has prospectively followed more than 230 diabetic divers who had completed 5,348 dives to November 1999. There have been no deaths, no episodes of DCI and 4 hypoglycaemic events, all of which were corrected with glucose paste. While these data must be interpreted with caution since they describe the activity of selected populations, they do suggest that focused diabetics can dive safely. There are also prospective studies addressing specific training of diabetic divers, and the occurrence of hypoglycaemia in chamber and open water dives.

Conclusions

If issues of selection and training can be addressed, it may be appropriate for SPUMS to modify its 8 year old recommendation that currently prohibits all medicated diabetics from diving.

Introduction

Diabetes mellitus, and the insulin dependent form in particular, has been described as a contraindication to diving in many major contemporary diving medicine or diving fitness texts.¹⁻⁶ Moreover, in the most recent "official" policy statement from SPUMS it was suggested that both insulin-dependent and medicated non-insulin-dependent diabetics should be advised against diving.⁷

However, there is increasing evidence that focussed and properly trained diabetics can and do dive with a low risk of diabetes-related complications. It is notable that the United Kingdom Sports Diving Medical Committee has permitted diving by selected insulin dependent diabetics since 1991.

There has been thoughtful analysis⁸ and outright criticism⁹ of the SPUMS diabetic diving policy from within the Society, and it is now 8 years since the policy statement was issued. The intervening period has seen a gradual shift in diving fitness assessment philosophy away from a prescriptive approach toward a more discretionary paradigm of fitness evaluation in which appropriate candidates make risk acceptance decisions after appropriate counselling. With this background, and since the theme for the 2000 SPUMS Annual Scientific Meeting is "Fitness for Diving", it is an appropriate time to review the issue of diving by diabetics.