

Children and diving

Children and diving: a review of SPUMS articles

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Key words

Children, recreational diving, scuba

Abstract

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This review of recent articles relating to scuba training of children published in the SPUMS Journal counterbalances some of the perceived bias of the diving industry organisations and affiliates. Additional case reports are supplied and factual information regarding diving deaths is related to the specific limitations imposed by childhood. The legal and moral implications are discussed and proposals are made to ensure that safe scuba diving experience is made available to children who are medically fit to undertake this.

Introduction

I was saddened to read the latest SPUMS Journal articles on children scuba diving.¹⁻⁸ Because of the apparent absence of critical editorial or peer review, I felt obliged to respond to the Editor's request for debate and share some facts and opinions contrary to the tenor of the publication.

I have tried, as far as possible, to restrict my comments to information now available in the Australian literature. As the original much-debated decision of SPUMS was to treat all divers below the age of 16 as children, requiring independent guardianship, and as it has some basis in law, I have persisted with this definition.

Case histories

Three previously published cases are selected to illustrate several important issues.⁹⁻¹²

CASE ONE

In 1971 I assisted at an autopsy on a previously healthy 14-year-old boy who drowned while under scuba instruction and performing shallow-water training exercises. On the surface, he cried out for help and appeared to be panicking just prior to disappearing. His body was recovered in 9 m of water. There were signs of facial and upper respiratory tract barotrauma, indicating that he was alive but possibly unconscious as he sank.¹³ He died of drowning, aggravated by over-weighting and panic.

CASE TWO

Another 14-year-old diver was trained in that same year, but presented a year later after acquiring reasonable experience. He was on an organised club boat training/excursion and became seasick and vomited before diving.

During a dive to 13 m, he lost contact with his more experienced adult buddy on the ascent and died from drowning, probably secondary to pulmonary barotrauma.

CASE THREE

The third case was certified as an open water diver at 12 years of age, and was very conscientious in her post-qualification training. Eight hours after a routine three-monthly dive at Manly, to 6 m for 37 minutes, her father drove her home over the Blue Mountains. Aware of the precipitation of decompression sickness (DCS) with altitude, symptoms started to develop. They got worse as the father and the daughter sought reassurance from each other. They managed to contact the Diver Emergency Service in Adelaide, and were diverted to Westmead Hospital for intravenous infusion and finally ended up in a hyperbaric chamber, where she really was in a very disturbed state. The anxiety, dyspnoea, hyperventilation, numbness, paraesthesias and confusional state, aggravated by the protracted assessments and treatments, were all totally identifiable as an acute psychological reaction. The whole family ended up with post-traumatic anxiety problems.

Clinical commentary

Why mention these three cases? Because they complement Walker's cases⁵ and illustrate some situations in which children are more vulnerable than adults to diving problems. They also illustrate the inadequacy of the 'diving limitations' for children divers to be discussed later.

In Case One, the effect on the parents, the instructor and the other students was catastrophic. It also had a profound effect on this observer and instigated a career-long drive to reduce diver deaths, especially in the young. The instructor was equally devastated.

Case Three was a normal 13-year-old female with a psychological profile of obsessionality and an anxiety-induced hyperventilation syndrome. The emotional basis for this syndrome is part of early adolescent development. This is a normal development, unrecognised and probably unrecognisable by most dive instructors or non-psychiatrically-aware doctors.

During my years as a specialist diving physician, I would have treated only a few dozen children scuba divers, and the majority presented for either upper respiratory tract barotraumas (sinus and ear) or psychological-based problems presenting during diving. The latter would be classified as normal developmental problems of immaturity by most psychiatrists. There were a few asthmatics.

The youngest scuba diving death I am aware of was aged seven years,¹⁴ although the University of Rhode Island did state that the 10- to 15-year age group represented 7.8% of the diving deaths in 1970.¹⁵ Child diving had a burst of popularity around those years, which may have explained this high incidence, not evident in the intervening years.

Review of SPUMS papers

There are some comments that are general and were not refuted in the papers published recently:

- There are no adequate evidence-based medical data available.⁷

Corollary: One can still rely on experience and case reports to illustrate the type of problems that exist and the means of prevention.

- Scuba kids are here to stay.¹

Corollary: So is dental caries. This does not mean that one should not try to prevent pathology.

- A strong emphasis on snorkelling skills is needed.¹

Corollary: We should encourage safety-orientated swimming and snorkelling training by qualified instructors. Medical fitness for snorkelling is described elsewhere.¹⁶

- Industry-based figures for accidents suffer from under-reporting.^{3,6}

Corollary: All statistics should be critically evaluated before publication, especially those that look too good to be true.

- Children are less physically powerful (most authors).

Corollary: Aquatic/physical fitness standards should be applied, as tidal currents are not influenced by the age of the diver. A 200 m unassisted swim in less than five minutes is a reasonable prerequisite.

- Children are emotionally immature (most authors).

Corollary: Age is the best correlate with maturity. Vigilant supervision of children and competent 'duty of care' is obligatory. They need to be genuinely supervised while diving, not just have a companion.

- Children are not little adults.^{5,7}

Corollary: Then let us not treat them like little adults.

Taking the specific presentations in order:

THE EDITOR'S OFFERING¹

The editor made his views clear. If SPUMS and specifically its president, Dr Walker, refuse to change their recommendations to comply with the diving industry's wishes, they will be seen as dinosaurs. His praise of the diving instructor organisations' (DIOs) "well-designed training programmes", "clear limitations" and "tightly controlled parameters set by the training agencies" both in his editorial and case report leave no doubt where his inclinations lie. His endorsements will be greatly appreciated by the marketing branches of the DIOs. But is the SPUMS Journal the place for them?

The Editor gave unqualified praise to the Belgium paper, which finds no problems with children scuba diving, and expresses regret that this decade-old study has not been previously published in the medical literature. One possible explanation could be the quality of the data and therefore its conclusions. He also delegated the responsibility of scuba training decisions to the parents/guardian who, unless they have comprehensive knowledge of medical and diving problems, will make uninformed judgments.

As the Editor, it is his privilege to agree or disagree with specific contributions. Nevertheless his endorsements are unsupported by argument, and conflict with the case reports supplied later in the Journal, the thoughtful guest editorial and previous contributions to the SPUMS Journal.¹²

CHILDREN AND DIVING: MEDICAL ASPECTS (BELGIUM STUDY)²

Its methodology and design need to be elaborated and defined before credence is given to this study, performed by a sports physician, an engineer and a nurse.

A prospective eight-year follow up of 234 children trained with scuba sounds impressive. However, questions relate to this population sample. The six- to 13-year-olds seem to not reflect the Belgian community, with an asthma prevalence of less than one fifth the normal.^{17,18} No other cardiac or respiratory problems, no grommets, no epilepsy and no emotional limitations were apparent in these children, influencing their fitness to dive. This is either a highly selected group, or it suffers from inadequate assessment or poor documentation. Such options can also be considered in appraising the rest of the clinical data and 'statistics'.

The series of 205 children extended over an average of five years, but with different children. It was not 205 children for five years. The drop-out rate, for a variety of reasons, was 25% per year! 'Drop-offs' were replaced. This is not a population survey; it is a survivor survey. Thus, it will predictably under-report morbidity and virtually exclude mortality. The study is not dissimilar to the misrepresentation of asthma and diabetes surveys also used to market the concept of scuba safety.¹⁹

Exercise ECGs and EEGs were performed on all candidates. The latter were performed to assess psychological maturity. This is not a well-established method in the English-speaking world. Will the proponents of child diver training in Australia and USA now recommend exercise ECGs and EEGs for children under 16? I was not, then, surprised to find that “hyperventilation is prohibited before the age of 10 years and strictly limited before the age of 14 years”. Water temperature greater than 12°C is classified as warm.

There seems to be a discrepancy between Belgium, in its diving medical knowledge and culture, and Australia. This requires clarification and extends to the fields of psychology, electroencephalography and population statistics. I am not sure about New Zealand.

No incidents or accidents occurred during the children’s 2216 open water dives. Not even ear equalisation problems (which they do define as incidents). The reporting procedure, if one existed, was not specified. To my knowledge, no other group has ever achieved such a spectacular safety record, except for the 800 pregnant women exposed to hyperbaric oxygenation in the USSR. They also had no complaints recorded.

CHILDREN AND DIVING EDITORIAL³

Cvitanovich and Langton gave a measured and informative resume of the problems of exposing children to hazardous situations, and especially a child’s different emotional capability in handling stress, problem-solving and responsibility. They warned of the unpredictability of behaviour in 10- to 15-year-olds. They re-asserted that supervision by an adult needs to be close supervision, not merely accompaniment by an adult ‘buddy’. Also, they stressed that informed consent of a child, even as they approach 15 years of age, can be a difficult issue. They gave references to the “well-documented risk of death and permanent disability” that can occur during dive training and that a small, prospective theoretical risk will almost certainly be viewed differently with the benefit of hindsight.

DCS IN 14-YEAR-OLD DIVER⁴

Davis presented an informative DCS case report illustrating “what can go wrong if the tightly controlled parameters set by the training agencies are ignored”. What this article did not address is what can happen even if the parameters are followed. Fortunately, Walker’s case reports⁵ and my own cases add this dimension.

I agree with his comment that “post-traumatic stress problems are not uncommon” after these injuries. If this paediatric patient had had a less satisfactory response, with permanent neurological or psychological damage, there would be an excellent case in law questioning the fullness of the disclosure and understanding of the dangers of scuba by the client against his guardian, the instructor and his original medical examiner (not Dr Davis). Because of the

statute of limitations as applied to children, this remains a possibility at least for a decade after the accident, until he reaches the age of 24 years, in most Australian states. I would also question the duty of care supplied by each of these potential defendants.

HOW OLD IS OLD ENOUGH?⁵

Dr Robyn Walker, president of SPUMS, documented the current (1992) policy, which is far more lenient than the previous one requiring a minimum age of 16 years before certification and the presence of a parent/guardian at the medical examination until the age of 18 years. SPUMS requirements were not relaxed on the basis of any data, but to comply with the Australian Standards. It may not be wise to allow commerce to dictate to medicine, but it did.

Walker, in her usual sensible manner, described nine paediatric deaths related to scuba diving. Of relevance in these cases was that:

- at least four were diving with their father;
- two were under training at the time (both died from pulmonary barotrauma with CAGE, probably initiated by panic);
- six died at depths less than 10 m;
- most drowned.

One of my three cases was under training at the time of death, at least two had panicked, and one was with her father. The two deaths occurred at a depth of less than 13 m, one from pulmonary barotrauma, and one from drowning. None of the combined 11 deaths died from DCS. These factual data should be kept in mind when assessing the DIOs’ safety recommendations (‘limitations’).

Prudent general advice was given about the problems relating to equipment, environment and rescue requirements and how these related to the physical and emotional limitations of childhood. Walker was also the only contributor to the debate who actually extracted case records of scuba child deaths and reviewed them.

HOW YOUNG IS TOO YOUNG?⁶

A dive instructor, technical and deep diver and diving physician, Mitchell’s presentation was originally written for PADI diving instructors, so perhaps the absence of case material was to be expected. He states that the figures supplied from CMAS and PADI indicate that the risk of serious injury is low, but these are likely to suffer from under-reporting.^{3,20}

RECREATIONAL DIVING TRAINING PERSPECTIVE⁷

Richardson uses diving-industry-generated data to promote the commercially valuable concept of children becoming scuba qualified. DIO figures have always been treated with suspicion and were refuted by Monaghan, a population statistician and one of PADI’s own instructors, in the

past.^{21,22} Richardson in a previous article in this journal used highly selective figures indicating scuba diving to be safer than swimming (hard to understand as one does both during diving) and bowls!²³

He now quotes figures of 3.5 million open water exposures with SNUBA, to depths up to 6 m, without incident! Those perennial problems that beset young adults learning to dive, such as claustrophobia and panic, aspiration of water, ear and sinus barotraumas, etc., were allegedly absent from his 3.5 million SNUBA experiences. This is surprising when all the other authors seemed to infer that children were more vulnerable to upper respiratory problems and emotional lability than adults.

Search of the internet site that he quoted in support of these figures, revealed not only no statistics on SNUBA, but no reference to SNUBA at all. I know only one child who used SNUBA, and he burst his tympanic membrane.

If one assumes that the reference quoted is an unfortunate typographical error and one searches the internet for information on SNUBA and SNUBA accidents, it becomes apparent that some commercial groups claim more than three million SNUBA exposures without a (legal) insurance claim against the company (internet search, followed by personal communication, Sub Sea Systems Inc, dated 19 August 2003). This is not the same as three million clinically injury-free dives!

Even if we restrict the 3.5 million dives as being free of 'legal or insurance-claim injuries', there are two provisos of note. Firstly, the legal waiver of responsibility for accidents, which according to the commercial web sites must be signed before exposure and indemnifies the operator, mitigates against any legal claims. Why would they need this if the activity is so safe? Also, perusal of some web sites demonstrates that litigation for such accidents has occurred.²⁴

I deduce that it all depends on where you get your figures from, on how you re-define and collect incidents, or how truthful you wish to be in their presentation.

Richardson uses the same distraction techniques in this article that are often employed by DIOs. Despite knowledge of the child deaths described in his references, he spends most of his extensive report arguing 11 Dorothy Dix questions. He refers to these as "the main issues...in considering children and scuba diving". DCS, not a major cause of recreational diving deaths, dominates his discussion (five questions). He also deals with other less relevant or easily coped with conditions, such as oxygen toxicity, thermal protection and developmental factors such as patent foramen ovale and respiratory physiology.

Using this approach, the most common cause of death in children divers, drowning, is ignored, whilst the major contributors to death, such as panic (mentioned only in

association with asthma, which excludes diving) and pulmonary barotrauma (reduced by not accepting anyone below the age of 10) are dismissed. This is a disingenuous approach that avoids tackling the real problems. He quotes two irrelevant projects that do not in any way bear on the genuine psychological immaturity problems described by Walker, Cvitanovich and Langton.^{3,5}

Richardson does, however, succinctly and openly describe the PADI programme and the safety limitations it employs.

- PADI junior open water scuba divers aged 10-11 are limited to 12 m depth and may dive only with a PADI professional or a parent/guardian who is a certified diver;
- PADI junior divers, aged 12-15, may dive to 18 m or 21 m if doing a PADI course, and must dive with a certified adult scuba diver.

These 'limitations' on junior divers, even if applied, would not prevent most child deaths. They are minimalist standards that equally apply to adults and do not address most of the genuine 'immaturity' concerns defined elsewhere.

Legal implications

In an increasingly litigious society, one can anticipate that morbidity and mortality are now likely to be followed by demands for compensation for an unfortunate outcome. This is especially so with injury to children. The medical examiner, for pecuniary reasons, is a more vulnerable target for litigation than the less affluent dive instructor.

The most obvious cause for action will be the death of a child. More frequent, but still very serious, are the problems of hypoxic encephalopathy of near drowning, hearing loss from barotrauma, chronic sinusitis and a prolific myriad of psychological reactions.²⁵ In the case of children there is an automatic extension of damages resulting from interruption to education, limitation of occupational potential and interference with social functioning.

One of these problems has been addressed by Davis.⁴ After the age of 24 years, it becomes more difficult for the diver described to take action for injuries caused whilst a child, but often the statute of limitations can be circumvented. For the medical examiner to demonstrate that the child was fully cognisant of the dangers is unlikely to be given credence once damage is experienced. The claimant will have logic as well as sympathy on his or her side. There is considerable doubt that a child can be held to understand the full implications of hazardous exposures, or be expected to behave in a mature manner during this stress, to avoid being injured.

Above the age of 16 to 18 years, most teenagers are considered to develop this responsibility. Thus they can then drive cars, fly planes, become surf life-savers, make financial commitments, etc. Scuba diving is not the exception that makes children act like adults. Most dive

instructors and doctors cannot accurately predict a child's maturity, and especially how they will react to life-threatening stress in the absence of expert supervision.

Diving limitations for children

In assessing these proposals, one must appreciate the motivation of the proponents. If it is a genuine health issue, then health professionals experienced in diving medicine should be involved. If a commercial DIO is involved, then allowance must be made for their pecuniary interests. A survey of 35 diving physicians conducted by Professor Taylor at the World Congress on Drowning, incorporated eight paediatric specialists and a wide spectrum of other medical specialists.²⁶ It disclosed the following. The minimum age recommended for diving by this group was 14.9 years (mean) or 16 years (median). For those whose children were already diving, the age of commencement was 15.7 years mean and 16 years median, suggesting that their own practice was even more conservative than their recommendations.

Some advisers, be they medically qualified or diving enthusiasts or both, are risk takers. Of these, some will restrict their risk-taking behaviour to themselves, in which case they are not much of a danger to others. Some risk takers will promote their behaviour to others, and this is a particular concern if the others are children, whose capability to comprehend and counter the danger they may face, or its sequelae, is limited. The other wild-card proponent is the 'wanna-be' expert who, in the absence of experience or genuine contributions, relies on being avant-garde and fashionable.

Despite the rhetoric of both the physicians and the DIO affiliates, PADI requires only that their 12- to 15-year-old diver needs to dive in the ocean with 'a certified diver'. The latter may have achieved this certification with less than a handful of open water dives. That is not an adequate supervisor, whether a parent or not. That is someone who themselves needs supervision. It certainly does not fulfil the requirements for supervision and guardianship of a child.

The most common contributors to scuba diving deaths are panic (39%), aspiration of water (37%) and fatigue (28%).²⁷ The most common ultimate pathological causes of death in younger divers are drowning and pulmonary barotrauma. The acclaimed 'limitations' on children divers will have little influence on these causes, and indeed they are virtually ignored in the propaganda campaign run by the DIOs.

It is my opinion that a child under the age of 16 should only have 'dive experiences' under the following, moderately safe, conditions:

- They want to, without parental, peer or promotional pressure;
- They are medically fit to do so;

- They dive to a maximum depth of 9 m. The nine-metre depth will certainly not prevent a child from developing pulmonary barotrauma, cerebral arterial gas embolism, any of the other respiratory tract barotraumias or anxiety reactions. It will, however, usually prevent decompression sickness.

- They are trained by and dive with a qualified instructor, and under the personal and total control of that instructor (i.e., not three or four trainees together).

The instructor has total responsibility for the child's safety. A buddy line between the child and the instructor is prudent to prevent uncontrolled ascents.

- After adequate training, all other dives are to be carried out only in calm and good environmental conditions.

This should be with the same controls as referred to above and with an experienced diver of instructor standard taking absolute control and responsibility.

- For open water diving the child should be aquatically and physically fit (200 m unaided swim in less than five minutes).

The child should not have the responsibility of rescuing others (such as a diver-parent). Unfortunately some have already experienced their parent's demise while diving. Irrespective of the child's total innocence, subsequent guilt can be catastrophic in these cases.

Giving a dive certificate to children under the age of 16, other than one that stipulates diving under the above very special conditions is, in my opinion, both courageous and irresponsible. I would be interested in all the contributors' responses, but especially those of the Editor, and Drs Walker, Cvitanovich and Langton on these safety recommendations.

This may make me a dinosaur, but I believe that a more accurate analogy for Dr Walker is a tall poppy being hacked at by commerce and fashion.

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