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THE RESPONSIBILITY OF DOCTORS PERFORMING "FIT TO DIVE" ASSESSMENTS

Michael Gatehouse and Tom Wodak

A doctor providing a medical service, be it advice, clinical or surgical treatment, is entering into a legal relationship with a patient which creates contractual rights and obligations and gives rise to a duty of care.

While the doctor is entitled to be paid for the service provided, the patient is entitled to expect that the service delivered will accord with the appropriate professional standard.

We wish to consider what constitutes the appropriate standard, in the context of an assessment by a hyperbaric doctor of the fitness of a candidate for an entry level diving course having regard specifically to the latent condition of patent foramen ovale (PFO).

A doctor must act in accordance with the practice accepted as proper by a responsible body of medical practitioners with commensurate experience and qualifications. What constitutes the requisite standard in particular circumstances will be determined by a court having regard to the skill, training, qualifications and experience of a reasonable body of peers of the doctor whose conduct is under scrutiny.

An entry level diving medical has a number of well established and essential ingredients which include, amongst other things, consideration of the age, cardiovascular status, respiratory function, patency of the Eustachian tubes and the circulatory system of the candidate. There can be no doubt that a hyperbaric doctor who conducts an examination without regard to one or more of the universally accepted ingredients has failed to meet the requisite standard of care appropriate to such an examination.

PFO, and specifically the implications to a person who has such a latent condition and who is or has aspirations of becoming a diver, is the subject of on-going debate and research. At present there are no clear and established guidelines for use by hyperbaric doctors.

We do not believe that sufficient is known of the implications PFO holds for divers to justify candidates undergoing expensive and potentially hazardous echocardiography. However there is the question of what the candidate should be told about PFO.

English and Australian courts have ruled that the duty of care owed by a doctor to a patient does not extend to requiring the doctor to warn and advise the patient of every conceivable potential risk of a proposed treatment or procedure, irrespective of the grave and serious nature of the consequences which could follow. In a recent English case a patient requiring vital spinal surgery was not informed by the surgeon of a remote, but nonetheless known, risk of quadriplegia associated with the procedure. Unfortunately the patient was rendered quadriplegic. Evidence was heard from experienced surgeons whose practice it was not to inform their patients of that particular risk. Ultimately the court found that the surgeon in question had not breached his duty of care to the patient by failing to give such a warning.

If a patient asserts a breach of duty on the part of a doctor, it is incumbent on the patient to establish, on the balance of probabilities, that, had such warning been given, he or she would have accepted and acted upon that advice. For example, the patient would have refrained from undergoing the procedure as a consequence of having been so warned.

It is our view that PFO, and its consequences for a person with that congenital abnormality who dives, is well understood by the general body of hyperbaric doctors. This makes it incumbent upon a doctor, conducting an entry level diving medical examination, to provide the candidate with a sufficient understanding of the condition, and its potential to cause injury and disability, to enable the candidate to make an informed decision whether to undergo investigation for PFO or to take up or to continue diving.

Our conclusion is based on two factors. Firstly to a non-diver, and indeed to those who dive or practice hyperbaric medicine, sport diving is a recreation associated with medical risks beyond those encountered in many other sporting and recreational pursuits. The health of participants in sport diving is of far more critical consideration than it is in, for example, tennis, skiing or sailing.

Secondly, there is a marked distinction between the circumstances of a critically ill patient seeking advice concerning a life saving procedure and those in which a person is contemplating taking up a new recreational activity. A court is more likely to sympathize with a position of a medical adviser seeking to assist a critically ill patient, where time is of the essence, than with a doctor consulted by a prospective diver.

It is largely for these reasons that we have formed the view that a doctor performing an assessment of fitness to dive ought to inform the candidate about PFO, the implications the latent condition has for divers and the technique available for its diagnosis and the risks associated with it. In so advising the patient the hyperbaric doctor greatly increases the probability that the obligation imposed upon him by the law will be discharged.

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SPUMS ANNUAL SCIENTIFIC CONFERENCE 1990

THE PATHOLOGY OF AIR EMBOLISM OF THE BRAIN IN DIVERS

Des Gorman and Stephen Helps

Introduction

The conventional pathophysiological model of air embolism of the brain circulation does not fit either animal or human data well. A revised model is proposed, based on bubbles precipitating deleterious effects in blood vessels and in blood constituents.

Aetiology

Bubbles can enter the brain arteries of divers either after pulmonary barotrauma or in decompression sickness (DCS).[1-6]

Pulmonary barotrauma is largely seen in novice and trainee divers[7] and occurs in 1:2,500 free/buoyant-ascents performed by submariners in training.[8,9] The latter occurs despite these candidates having a normal chest X-ray and a spirometric ratio of FEV_1 to FVC of greater than 75%.

The lung vessels act as a filter for venous bubbles in DCS,[10,11] but bubbles can overload this mechanism and can also by-pass it via shunts such as a patent foramen ovale.[4-6] Arterial gas embolism (AGE) may underlie much of the brain damage in DCS.[1]

The incidence of AGE of the brain in Australasian divers and trainees is unknown.

Bubble distribution

Bubbles distribute in large vessels in accordance with blood flow and their buoyancy relative to blood, and in small vessels with flow alone.[12-15] In divers this distribution and the invariable upright posture on ascent explains the preponderance of brain involvement.[8,9] Bubbles entering one carotid system tend to distribute ipsilaterally and the middle cerebral artery is primarily affected.[8,9,16]

These bubbles usually do not become trapped and pass through the arteries, arterioles and capillaries to the veins;[13,14,17] to be collected in jugular vein air traps introduced into experimental animals.[15,17-20] This passage of bubbles is promoted by the relatively large calibre of the venous end of capillaries, the hypertension and vasodilatation that follow embolism of the brain-stem vasomotor centres and the local vasodilatory response to bubbles.[16,17]

Indeed, bubbles will only become trapped when they are large enough to occupy several generations of branching arterioles such that net surface tension pressure exceeds cerebral perfusion pressure.[13,14,17] The vessels at the junction of the grey and white matter may be predisposed to such trapping.[21]

Effects of bubble trapping

Very large bubbles or bubbles in a hypotensive diver may be trapped to block flow in a region of the brain; the degree of ischaemia and the development of an infarct is dependent upon the adequacy of the collateral circulation.[2,18,19,21-24] Most of these larger bubbles will however only be trapped temporarily and will eventually be dis-