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Affiliated organisations:
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UK Sport Diving Medical Committee

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Enclosed with the newsletter:
The new medical questionnaire

Asthma and diving

Asthmatics are not allowed to dive in several countries because of the perceived excessive risk of pulmonary barotrauma due to air trapping. We do not know the absolute risk of diving with asthma but theoretical considerations and case reports confirm that there is danger involved. In the UK, divers with allergic asthma are permitted to dive, although those with exercise or emotion induced bronchospasm are banned. There cannot be an absolute distinction since there are many whose symptoms are affected by a variety of stimulants in different settings.

The British Thoracic Society is considering formulating guidelines on diving with lung disease based on the available published evidence. It is not possible to perform randomised controlled prospective studies but there are reports of the prevalence of asthmatics in decompression incident statistics. The current UKSDMC guidelines

attempt to identify those with exercise induced asthma by performing an exercise test, but there are limitations with this technique particularly if the inspired air is at room temperature, compared with the cold air delivered by most regulators.

Some organisations advise using inhaled nebulised saline to check for salt water induced bronchospasm. The incidence of such bronchospasm is unknown in normal individuals, let alone well controlled allergic asthmatics. This may lead to the unnecessary exclusion of individuals from sport diving. As ever, the advice given to sport divers is based on limited scientific information and theoretical concerns.

In a recent survey of almost 3000 divers, 7.4% reported a history of asthma although only 0.5% continued to use inhalers. Medical referees know that asthma is one of the most common reasons for referral and this accounts for around 30% of

all referrals. Extrapolating these figures to the total diving UK population leads to an estimate of over 7000 divers with a history of asthma, and around 470 divers with active asthma requiring medication.

The most recently published incident statistics from the Divers Alert Network reveal that only 1.5% of divers involved in incidents had a history of asthma. They are therefore not over-represented. Only one case out of 57 fatalities was thought to be directly related to asthma and this was in an individual who was otherwise physically unfit to dive.

We will continue to monitor safety statistics examining the prevalence of asthmatics in the incident population but the current guidelines appear to be working. UKSDMC representatives are on the British Thoracic Society committee and we will keep you apprised of developments.

Trapped pollen in SCUBA tanks

Divers are trained to protect the intake system of compressors from exhaust fumes but many may not be aware of other hazards in the atmosphere. A recent case report warns of the risk of filling tanks in unprotected areas where circulating pollen particles can be transferred to the tank despite the usual filter precautions in the compressor. They studied a young diver with grass-induced

hay fever who had attacks of dyspnoea underwater after using SCUBA filled from a compressor in the open air. Samples of the compressed air were taken from the system in the winter and summer, ie before and during the pollen season and significant levels of tiny particles were detected. They went on to perform allergen testing on the diver and confirmed an antibody response to this par-

ticular allergen. The authors conclude by recommending that tanks should be filled in protected areas during the pollen season. Existing filters are not able to prevent ingress of such small particles.

Pollen trapped in a SCUBA tank: a potential hazard for allergic divers. Astarita C, Gargano D, Di Martino P. Ann Intern Med 2000;132:166-67

Patent foramen ovale and migraine

“Paradoxical embolism may be an underlying cause of the migraine attack”

The link between patent foramen ovale and decompression sickness is becoming clearer and some divers are now having their septal defects closed using a percutaneous device (often the Amplatzer occluder). Recent research elsewhere has suggested a role for patent foramen ovale in other clinical syndromes. Paradoxical embolism through a septal defect is a recognised cause of stroke in young patients and recently evidence has emerged of a relation between PFO and some forms of migraine. The cause of migraine remains uncertain and there is a risk of permanent cerebral damage in some young patients. A study of patients with migraine was published in *Neurology* last year showing an excess prevalence of PFO in 113 subjects suffering from migraine with aura (48%) compared to 25 normals (20%) and 53 subjects with migraine and no associated aura (25%). These differences were highly statistically significant

($p=0.002$). The authors suggest that paradoxical embolism may be an underlying cause of the migraine attack in the first place and this can lead to permanent damage in some individuals. This supports a smaller study published in 1998 finding a similar excess prevalence of right to left shunting detected by transcranial Doppler ultrasound in migraine with aura sufferers.

Certainly the pattern of cerebral blood flow demonstrated by Doppler ultrasound during a migraine attack is very similar to that of embolism. It is unknown if the migraine attacks could be prevented by occluding the septal defect but this may be the next step. Anecdotal evidence suggests an excess incidence of migraine in divers with decompression sickness.

The PFO's in these studies were detected by transcranial Doppler ultrasound, currently the most sensitive non-invasive test available for detecting

right to left shunting. It involves strapping a low frequency ultrasound probe to the side of the head to monitor the blood flow in the middle cerebral artery while injecting agitated saline containing small air bubbles. This has almost the same degree of sensitivity as transoesophageal echocardiography, the gold standard. Divers with easily provoked decompression sickness and a history of migraine or skin bends should be considered for further investigation.

Neurology 1999 May 12;52 (8):1622-5. Potential source of cerebral embolism in migraine with aura: a transcranial Doppler study. Anzola GP, Magoni M, Guindani M, Rozzini L, Dalla Volta G

Cerebrovasc Dis 1998 Nov-Dec;8 (6):327-30. Migraine with aura and right-to-left shunt on transcranial Doppler: a case-control study. Del Sette M, Angeli S, Leandri M, Ferrero G, Bruzzone GL, Finocchi C, Gandolfo C

Obesity and diving

“The BMI limit has now been removed”

The risks of obesity when diving include the increased prevalence of hypertension, cardiovascular disease and diabetes. Obesity also suggests a reduction in general physical performance and this may affect an individual's ability to cope in a crisis, for example if rescuing or towing a buddy.

The UKSDMC guidelines previously included a BMI cut-off of 30 and, if exceeded, divers were usually assessed by medical referees who often

performed exercise testing.

The BMI limit has now been removed and provided divers are able to complete their training including the tests of physical fitness that are involved then they should be fit to dive. All too frequently divers were being referred because of a BMI of 31 and yet were found to be physically fit and easily capable of coping with the physical demands of diving.

Measurement of skin fold thickness gives a better indication of total body fat but the

most relevant standard here is the exercise test involved in diving training. If divers are unable to complete this standard then they should not be allowed to continue with their training and can then self refer for further assessment although the usual cure will usually be to lose weight and increase general fitness.

The obesity and diving guideline will be rewritten to take account of these changes.

Saturation diving and male fertility

Investigators in Australia and Scotland have described a significant drop in the quality of semen during a saturation dive which involved one week at 4.6 Bar and a total of 33 days at pressure. Semen samples were taken during the programme and during a follow-up period of almost 10 months. The fertility of the divers was seriously compromised at day 82. This complication of saturation diving has not been described previously. Other effects of saturation diving include small airways dysfunction and

changes in lymphocyte population numbers leading to a relative immunosuppression. This explains the increased risk of bacterial infection, often with pseudomonas. Changes in neuropsychological function have also been detected, including altered memory and cognitive ability with corresponding brain stem reflex abnormalities and EEG changes.

Impact of a deep saturation dive on semen quality. Aitken RJ, Buckingham D, Richardson D, Gardiner JC, Irvine DS. *Int J Androl* 2000;23(2):116-20

Next committee meeting

The next committee meeting has been arranged for 24th September 2000. Contact the secretary if you would like a case to be discussed at this meeting (details on front page).

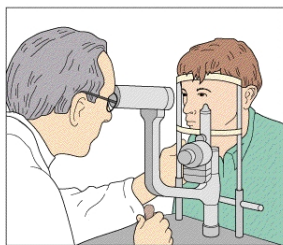
Radial keratotomy and diving

Radial keratotomy is a technique using excimer laser to reshape the lens of the eye to correct refractive errors. Interestingly its use developed after a schoolboy in Russia was involved in a fight and his glasses were shattered. The fragments of glass did not penetrate the eye but instead adhered to the cornea in a radial pattern. When the cornea healed it became flatter and this change of shape led to a correction of the boy's short sightedness. After laser surgery there are reports of additional changes in corneal shape at altitude leading to further central corneal flattening and hyperopia. This was observed in two climbers who tackled

Mount McKinley and Mount Everest after eye surgery. Such changes take between 6 and 24 hours to develop and are reversible. A small study has been performed to exclude a similar reverse effect under hyperbaric conditions. This involved detailed ophthalmological examination before and after a dry chamber dive with a normal control group. No significant difference was found in the short study period. The authors conclude that recreational diving after radial keratotomy is safe.

Effect of increased atmospheric pressure on radial keratotomy. Peters NT, Borer RC Jr, Strauss MB. *J Cataract Refract Surg* 1999 Dec;25(12):1620-3

A new diagnostic test for decompression sickness?



The slit lamp- a readily available diagnostic tool.

The first report of decompression sickness was Boyle's description of bubbles in the eye of a viper which had been placed in a vacuum chamber. Dr Mike Bennett (Medical Director of the department of Diving and Hyperbaric Medicine in the Prince of Wales Hospital, New South Wales, Australia) described the use of a slit lamp to examine the relation of tear film bubbles and decompression sickness at the recent SPUMS annual scientific meeting.

Bubbles are known to develop beneath contact lenses and can cause visual disturbance and this was not thought to be clinically important until similar tear film bubbles were detected in a chamber attendant who did not wear contact lenses. A study of 11 volunteers was

then performed in a decompression chamber where they were compressed to 4atm for 15 minutes and then decompressed. Bubbles were present in most subjects after this dive. The bubbles form in several ways including directly from the globe or aqueous humour, from the conjunctival blood vessels, or from the lacrimal glands, although this appears less likely. Dr Bennett suggests a further possibility of the rupture of the meibomian gland cells and this could explain the persistence of bubbles in the tear film for several days after decompression. There is limited evidence of an association between the number of bubbles and the decompression stress.

The potential advantage of this technique is that if an asymptomatic diver has no bubbles de-

tected in the tear film then decompression sickness is unlikely. Slit lamps are more readily available than complex and expensive ultrasound equipment and could potentially save considerable inconvenience and expense in transporting divers to recompression facilities.

More work needs to be performed but this is a developing area.

For further information:

Bennett M. Tear film bubbles and decompression illness: finally a diagnostic test to cry for. *SPUMS* 1999;29(4):233-238

Mekjavic IB, Campbell DG, Jaki P, Dovsak PA. Occular bubble formation as a method of assessing decompression stress. *Undersea Hyper Med* 1998;25(4):201-210

Strath RA, Morariu GI, Mekjavic IB. Tear film bubble formation after decompression. *Optometry and Vision Science* 1992;69:973-975

UK Sport Diving Medical Committee

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