

Dr Ian Unsworth

Do you think there is a danger of synergism between venous gas emboli and steroids increasing the risk of femoral head necrosis?

Dr Fred Bove

These people have a reasonably high incidence of aseptic bone necrosis because of steroids. I had an interesting diver come to me who had a seminoma which had metastasised to his lungs. He was a 45 year old millionaire. As a young guy he had made a lot of money in real estate. He came in with no hair, greyish, with burns on his chest. He had been treated for a fairly bad seminoma. The lesions in his lungs were smaller than they had been and he was on chemotherapy and steroids. He wanted to come down here on a trip around the world and he had been told that he had about a 5% chance of surviving. I just said do whatever you want to do and he did. He wrote me a letter and said it was the nicest trip he had had in his life. He was writing from the Sloane Kettering in New York where he was because of pulmonary metastases. I do not think he is alive today.

Dr Bob Paddock

You did not comment on hearing problems. I recently examined an 18 year old who had a total hearing loss in one ear and a perforated drum in the other with a 20% loss. I rejected him for diving. He went to another doctor, an otologist, but not a diver, and he was passed by the otologist.

Dr Fred Bove

It is amazing that anyone would clear somebody for diving with a chronic perforation. Even non-diving ear, nose and throat specialists know that one should not let somebody submerge their head in water when they have a chronic perforation. That otologist is malpracticing in the United States. Anybody with a chronic perforation should not dive because they will always get water in the middle ear and infection often follows.

Joe Farmer at Duke University tells me that chronic perforations are not because of poor healing in the drum but because of inadequate Eustachian tube function. The perforation is chronic because the person cannot ventilate the middle ear normally. There are ways to treat that. Anyone with a total neurological deficit of hearing in one ear is not fit to dive because if anything happens to the hearing in the other they are 100% deaf, and that is a real problem. Those are two important ENT considerations that do not come up very often in the States because everybody agrees with them, except for an occasional otologist.

Question:

Should people who have had prosthesis placed in the middle ear dive?

Dr Fred Bove

There are people who have tympanoplasties and artificial bones placed in the middle ear. To me that is the ultimate in microsurgery, for someone to grind up a couple of pieces of plastic, shape them like middle ear bones, put them in place, put a new tympanic membrane on and restore some hearing. It only takes one little ear squeeze to wipe the whole thing out. In the States the ENT people tell their patients that the insurance will only pay for the first operation (about \$1,800 an operation) so if you want to go diving, put 1,800 bucks in your piggy bank, because when that ear is damaged, nobody else will pay for the repair. They can dive, but they run a high risk of wiping out all that nice surgery. It is not going to hurt the surgery if the person has good Eustachian tube function and knows enough to keep his ears properly cleared.

#### WHAT SHOULD WE ASK FOR IN A SPORTS DIVER MEDICAL?

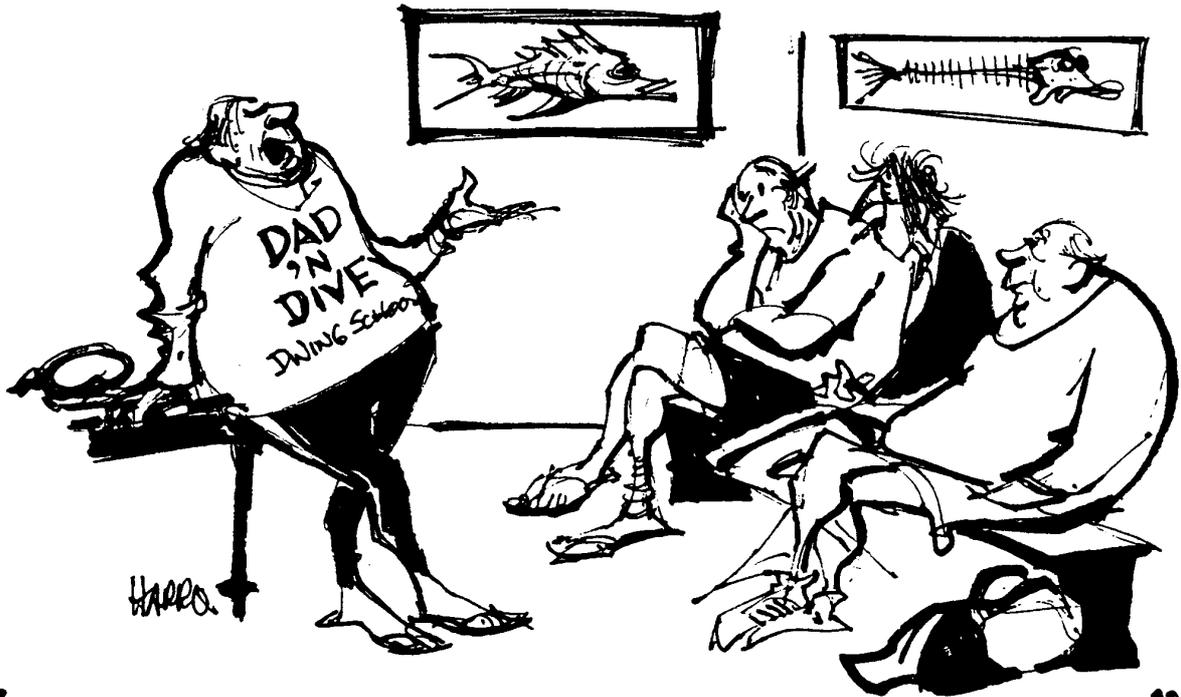
John Knight

The cartoon (Fig 1) which appeared on the front of the SPUMS Journal (July-September 1981) is horrifyingly true. Often somebody who has a physical defect not compatible with safe diving goes to a knowledgeable diving doctor and is knocked back. He then goes to another doctor and suppresses the information about asthma or angina. He cannot suppress being overweight or hypertensive but he can find some doctor who does not know anything about diving. I think everybody would agree that sports divers do not necessarily have to meet the same high standards of physical fitness required for military and commercial divers. For one thing, many of us are very much older than the working commercial or military diver and we do not seem to have more than our fair share of accidents. I approached the idea of producing a diving medical suitable for sports divers by making a list of what I thought were absolute contraindications to diving. (Table 1)

#### ABSOLUTE CONTRAINDICATIONS

I decided that conditions that were likely to cause you to go unconscious underwater were a complete bar to sensible people going diving.

Conditions likely to cause pulmonary barotrauma make it extremely unwise to go diving, and conditions that cause breathlessness on exertion make it stupid to go diving. Then there are various ear conditions that make diving impossible without risking hurting oneself.



“ IF AT FIRST YOU FAIL YOUR MEDICAL, GET ANOTHER DOCTOR! ”

I take the attitude that the doctor is not God, he is just an advisor. So the most one can do with a budding sports diver is to say to him, “Well, I think you should not dive and these are the reasons”. Then if he insists on learning to dive it is up to him to find somebody who will teach him. The doctor tells him about his limitations.

Conditions Likely to Cause Unconsciousness

The only medical conditions that will give you sudden unconsciousness are epilepsy and diabetes treated with insulin. Many diabetics do not recognise their hypoglycaemia coming on. There are diabetics who say “I know when I am getting hypoglycaemic and I can take my barley sugar and be right”. I ask them, “Are you going to be able to find the pocket in your wetsuit where you keep your barley sugar, unwrap it, take your regulator out of your mouth, pop the barley sugar in, put your regulator back, all while you are feeling rather queer?” Most of them agree that it is asking a bit too much.

As far as I know none of the diabetics who I have told that they should not dive have gone off and found another doctor and got the certificate.

I saw one university student who was an epileptic, not quite controlled, who also had asthma. He wanted to learn to dive, but he listened to me and took up parachuting instead. Hang-gliding is probably safer than diving if you have all the conditions in Table 1.

Conditions Likely to Cause Barotrauma

A previous spontaneous pneumothorax has shown that the person’s lung is liable to burst. There is no point in

TABLE 1

ABSOLUTE CONTRAINDICATIONS TO DIVING

CONDITIONS LIKELY TO CAUSE

UNCONSCIOUSNESS

- Epilepsy
- Diabetics on insulin

PULMONARY BAROTRAUMA

- Previous spontaneous pneumothorax
- Obstructive airway disease
- Lung cysts
- Previous thoracotomy
- Asthma

BREATHLESSNESS ON EXERTION

- Asthma
- Obstructive lung disease
- Poor effort tolerance
- Angina
- Coronary artery disease

EAR PROBLEMS

- Inability to clear ears
- Perforated ear drum
- Previous middle ear surgery with the insertion of a prosthesis
- Previous rupture of an inner ear window

exposing him to pressure changes. If there is a cystic area in the lung it usually has a narrower entrance than would be expected for the volume. Some of them do not empty properly. One does not know which are going to empty properly and which are not. I think anyone whose X-rays show lungs cysts should not dive.

Obstructive lung disease has the same problem, the air comes out slowly. If someone with this problem bobs smartly up to the surface, part or all of the lung is going to be overdistended. Professor Colebatch's work in Sydney suggests that some people have lungs that stretch at unequal rates. This causes stresses at the junctions between the unequal rates. The slowly expanding bit holds back and the rapidly expanding bit tears itself off. The result is an air embolism.

I have always thought that a previous thoracotomy could cause problems if bits of the lung are tethered. The lung could tear at the junction between the normal and tethered bits.

Everyone says that asthmatics should not dive, because they are prone to pulmonary barotrauma. David Clinton-Baker's case is the first one I have heard of where an asthmatic has had a pulmonary barotrauma. I have heard of a number of asthmatics who have had respiratory problems diving, but they were breathlessness problems, not pulmonary barotrauma problems.

#### Conditions Causing Breathlessness

I put asthma first because many asthmatics want to be active chaps doing this and that and the next thing. Give them cold, dry air to breathe, with a little cold water coming in through the regulator and they get the salt water aspiration syndrome. They also get their asthma, and the two together make breathing extremely difficult. Especially if they are using a diving school regulator which do not always function very smoothly. Panic on top of all this gives them real trouble.

Obstructive lung disease makes you breathless on exertion as does poor effort tolerance. That is what the older ones among us have, because we do not stress ourselves very often. I am quite certain that somebody who has angina should not go diving. So far, in seven years doing diving medicals, I have not seen anyone with angina who wanted to learn to dive. People with coronary artery disease should not go diving, for all the reasons that Fred Bove gave.

#### Ear Conditions

Inability to clear the ears will cause aural barotrauma.

A perforated ear drum will let water into the middle ear. Oddly enough, salt water is not as bad for the middle ear as fresh water. In fresh water practically every time infection follows, while only a relatively small proportion of perforations in salt water get infected. Perforation also

puts cold water against the inner ear. This causes vertigo which is not a good idea when underwater.

Previous middle ear surgery with the insertion of a prosthesis means that any failure to equalise can wreck the surgical result. The real problem is that the second time the chances of a good result are much reduced. One is very much better to hang on to the hearing that has been restored. George Gray tells people who he knows are scuba divers that they should give up diving and explains why when he does a stapedectomy.

I think anyone who has ruptured an inner ear window, whether it is diving or lifting heavy weights, or straining of any sort, has demonstrated that he has a weak inner ear window and that it is quite possible that it will go again. One diver I know ruptured an inner ear window, and had it mended. He got his hearing back, which was lucky. He did it again, and got his hearing back a second time after the second repair. I have pictures of drops of fluid coming out of his round window membrane. It really was amazing to see those drops of fluid coming out. We eventually persuaded him to sell his gear. He was lucky to have got his hearing back twice.

I think all these are real contraindications to diving.

#### RELATIVE CONTRAINDICATIONS

Then there is a group of relative contraindications to diving. Those with a forced respiratory volume in I second (FEV) to forced vital capacity (FVC) ratio below 75% figure in the burst lung statistics more often than they should. They are more likely than normal to burst their lung during an emergency ascent. But by coming up slowly and never running out of air underwater, and not holding their breath when being bounced up and down by the waves, such a person will probably get by safely. I know a lot of divers who have FEV/VC ratios of less than 75% who dive quite happily. One is an abalone diver whose ratio is 55%. He certainly has obstructive lung disease. But he earns \$80,000 a year for about 100 days work. There is no other way he can possibly earn the same money, so he goes on diving.

TABLE 2

#### RELATIVE CONTRAINDICATIONS TO DIVING

FEV1/VC ratio less than 75%

Poor physical fitness

Previous myocardial infarction

Pregnancy

Another relative contraindication to diving is poor physical fitness, and that, if we are truthful, applies to a lot of us.

Someone who has had a myocardial infarction or coronary artery surgery should not go diving until he has exercised on a treadmill and proved that he can really turn on the energy.

Pregnancy is a contraindication to diving, but there are very few pregnancies, that go on for more than nine months, so it is a temporary one.

## DIVING MEDICAL EXAMINATIONS

How are we going to avoid Fig 1? Diving instructors have an economic incentive to put as many students through as possible. Because more people in their fifties retire now, instead of in their late 60's, there are many older people who feel well enough to go out and learn to dive. We have to try to educate the rest of the medical fraternity. We have got to try to persuade the diving instructor organisations that using doctors who know what they are talking about is a good idea. We have to give some guidelines to ourselves.

The national qualifications scheme for divers in Australia sends out a blue medical examination form reprinted from the previous Australian standard of 1972. It includes various disqualifying conditions such as varicose veins, which is not in the present standard, but VD still is. I can see that syphilis is a drawback to being a fit person, but I do not think that NSU or gonorrhoea, or any of the other venereal diseases really influences one's fitness for diving. I do not think it is necessary for a diving medical to ask that question, so I have left it off my modification of the form (Figs 2 and 3). The medical examination forms from the present standard 2299 (1979) have been printed in the SPUMS Journal.(1)

### Specific Tests

I do not think that there is any point in doing ECG's on people who are asymptomatic. That is an anaesthetist's viewpoint. I watch an awful lot of arrhythmias come and go during anaesthesia. I never give any drugs, except perhaps some atropine and the arrhythmias that have come on during the anaesthetic always go away. Mind you, I have only given some 20,000 anaesthetics, so maybe in the next twenty will be the one that does not go away. But I believe, from my own experience and from the experience of people who have done 24 hour monitoring of asymptomatic people living their ordinary lives, many of whom developed gross abnormalities on the ECG record for short periods without any problems, that most abnormalities do not matter two tuppenny hoots. That is if one is healthy. If there are symptoms it is a different matter. If one has no symptoms, ECG's are not awfully helpful

The paper in the SPUMS Journal (2) by Peter Wilkins tells that the United States Air Force has given up doing stress ECGs on asymptomatic people. What I have read about ECGs as prognosticators of having a coronary, suggests that they are not a good one. There are false positives and false negatives.

Exercise tests are also not good prognosticators. The USAF had one in 20 with an abnormal exercise ECG, but after cardiac catheterisation and selective angiograms, only one in three hundred was grounded. Presumably, the other 14 who were investigated were not in fact positives. I do not believe that a test which gives you that number of false positives, which costs a lot of money to do and which should be done in a proper cardiac laboratory with full resuscitation facilities, and a physician standing by, is good value for money. It is not acceptable to put a person on an exercise bike, put on ECG leads and tell him to pedal away, because there is no way of knowing which one is going to say "I've got a terrible pain in my chest" and collapse.

Chest X-rays I feel are quite helpful because lung cysts are quite undetectable except by X-ray. If somebody is passed on the basis of his history and he happens to have a lung cyst and dies sometime in his early dives, you might feel that you had let him down by not doing a relatively cheap examination.

Audiograms are another thing that people have doubts about. I think they should be done because the man who has damaged his round window twice, had only a mild hearing loss, but we had his previous record, which was an absolutely normal audiogram. There he was with a high tone loss and a bit of loss over the lower tones, and over the next four days it got very much worse. He had done it in fresh water and developed a middle ear infection. Had it not been for the fact that we had a normal baseline in would have been very difficult to persuade the ENT surgeon into the operating theatre. We live in a very noisy society. People go out and do noisy things like shooting clay pigeons or targets, without ear protection. People earn their living driving bulldozers which are very, very noisy. It is interesting that Australian country children have worse hearing than city children, because they travel on tractors from an early age. These are some reasons why I think that audiograms should be done to establish a baseline.

### Specific questions

I have added some questions on exercise because that seems to me to be the easiest way of checking up whether a bloke is reasonably fit. If he is playing Australian rules football every Saturday afternoon, the coach will make sure that he takes some exercise between Saturdays. If you are playing a game that goes on for 90 minutes of constant running you are reasonably fit. Recently I have been doing the step test that was recommended for the UK commercial divers (3) on all my diving candidates. That is, they step up and down onto a 17 inch chair, at 30 steps a minute for 5 minutes. They sweat. Then counting for 30 seconds three times, you first take the pulse a minute after they stop stepping, then at two minutes and three minutes. Add the three 30 second pulse counts together and the answer should be less than 190 if they are fit. About 80% of those I have tested pass, most of them quite comfortably. I would not have expected some of those to pass. But they were stepping up and down at the right rate. I do not know if it is a good test of fitness, but it is a lot easier to organise than



# Diving Medical Centre

MEDICAL HISTORY QUESTIONNAIRE  
Please fill in pages 1 and 2

FIGURE 2

FIGURE 3

NOTES

1 SURNAME	OTHER NAMES	2 DATE OF BIRTH	3 SEX	4 SINGLE MARRIED OTHER
3 ADDRESS		6 TELEPHONE (WORK)	7 TELEPHONE (HOME)	10 RELATIONSHIP
8 OCCUPATION		9 NECT OF LIM	10 RELATIONSHIP	11 TELEPHONE
9 ADDRESS OF NEET OF LIM		12 DO YOU TAKE PHYSICAL EXERCISE? DESCRIPTION OF ACTIVITY	YES	NO
10		13	YES	NO
14 FREQUENT		15 ARE YOU EASILY TIRED AFTER EXERCISE?	YES	NO
15		16 DO YOU GET A PAIN IN YOUR CHEST AFTER EXERCISE?	YES	NO
16		17 DOES SHORTNESS OF BREATH LIMIT YOUR ACTIVITIES?	YES	NO
17		18 DO YOU HAVE ANY DISEASE OR DISABILITY AT PRESENT? NAME OF CONDITION	YES	NO
18		19 ARE YOU TAKING ANY TABLETS, MEDICINES, OR DRUGS? NAMES	YES	NO
19		20 RHEUMATIC FEVER	YES	NO
20		21 SWOLLEN OR PAINFUL JOINTS	YES	NO
21		22 HEART DISEASE	YES	NO
22		23 HIGH BLOOD PRESSURE	YES	NO
23		24 ABNORMAL SHORTNESS OF BREATH	YES	NO
24		25 PLEURISY OR CHEST PAIN	YES	NO
25		26 PNEUMONIA	YES	NO
26		27 BRONCHITIS	YES	NO
27		28 COUGHING UP BLOOD	YES	NO
28		29 TB	YES	NO
29		30 CHRONIC OR PERSISTENT COUGH	YES	NO
30		31 PNEUMOTHORAX (COLLAPSED LUNG)	YES	NO
31		32 ASTHMA OR WHEEZING	YES	NO
32		33 ANY CHEST INJURY OR OPERATION	YES	NO
33		34 HAY FEVER	YES	NO
34		35 SINUSITIS	YES	NO
35		36 ANY OTHER NOSE OR THROAT TROUBLE	YES	NO
36		37 DEAFNESS OR RINGING IN THE EARS	YES	NO
37		38 GIDDINESS	YES	NO
38		39 DISCHARGING OR INFECTED EARS	YES	NO
39		40 OPERATION ON THE EARS	YES	NO
40		41 WEAR GLASSES OR CONTACT LENSES	YES	NO
41		42 KIDNEY OR BLADDER DISEASE	YES	NO
42		43 DIABETES	YES	NO
43		44 INDIGESTION OR PEPTIC ULCER	YES	NO
44		45 VOMITING BLOOD	YES	NO
45		46 BLEEDING FROM BACK PASSAGE	YES	NO
46		47 JAUNDICE OR HEPATITIS	YES	NO
47		48 GLANDULAR FEVER	YES	NO
48		49 MALARIA OR OTHER TROPICAL DISEASE	YES	NO
49		50 SEVERE LOSS OF WEIGHT	YES	NO
50		51 HERNIA (RUPTURED)	YES	NO
51		52 ANY SKIN DISEASE	YES	NO
52		53 ANY REACTION TO DRUGS OR MEDICINES	YES	NO
53		54 ANY ALLERGIES	YES	NO
54		55 FARTING OR BLACKBOOTS	YES	NO
55		56 FITS OR EPILEPSY	YES	NO
56		57 MIGRAINE	YES	NO
57		58 SEVERE HEADACHES	YES	NO
58		59 SEVERE DEPRESSION	YES	NO
59				

60 CHAUSTROPHOBIA	YES	NO
61 ADMISSION TO A HENTAL HOSPITAL		
62 OTHER HENTAL ILLNESS		
63 UNCONSCIOUSNESS		
64 CONCUSSION OR HEAD INJURY		
65 ANY BROKEN BONES		
66 ANY INJURY TO JOINTS		
67 ANY BACK INJURY		
68 ANY PARALYSIS OR MUSCULAR WEAKNESS		
69 HAVE YOU BEEN IN HOSPITAL		
70 HAVE YOU HAD ANY OPERATIONS		
71 HAVE YOU EVER BEEN REJECTED FOR INSURANCE		
72 HAVE YOU EVER BEEN UNABLE TO WORK FOR MEDICAL REASONS		
73 HAVE YOU EVER BEEN ON A PENSION		
74 DEPTURES		
75 DO YOU SMOKE		
76 APPROXIMATE NUMBER OF CIGARETTES PER DAY		
77 DO YOU DRINK ALCOHOL		
78 APPROXIMATE DAILY CONSUMPTION		
79 HOTTON SICKNESS (CAR, SEA OR PLANE)		
80 DO HAVE ANY DISABILITY RELATED TO FLYING		
81 ANY OTHER ILLNESS OR INJURY		
82 HAVE YOU EVER LIVED IN THE SAME HOUSE AS A PERSON WITH TB		
83 HAS ANY MEMBER OF YOUR FAMILY HAD TB		
FEMALES ONLY		
84 DO YOU HAVE ANY DISABILITY DURING OR BEFORE PERIODS?		
85 ARE YOU PREGNANT?		

DIIVING HISTORY

1 APPROXIMATE DATE OF FIRST SMOKELE DIVE	
2 APPROXIMATE DATE OF FIRST COMPRESSED AIR DIVE	
3 APPROXIMATE NUMBER OF COMPRESSED AIR DIVES SINCE	
4 GREATEST DEPTH OF ANY DIVE	
5 LONGEST DURATION OF ANY DIVE	
6 APPROXIMATE DATE OF FIRST DIVE ON MIXED GASES (PRO DIVERS ONLY)	
7 APPROXIMATE NUMBER OF DIVES ON MIXED GASES (PRO DIVERS ONLY)	

HAVE YOU EVER SUFFERED, OR DO YOU NOW SUFFER FROM ANY OF THE FOLLOWING DISORDERS RELATED TO DIVING?

8 EAR SQUEEZE	YES	NO
9 RUPTURE OF EAR DRUM		
10 DEAFNESS		
11 GIDDINESS OR DIZZINESS		
12 SINUS SQUEEZE		
13 LUNG SQUEEZE		
14 RUPTURED LUNG (BURST LUNG)		
15 BRONCHITIS		
16 PNEUMOTHORAX		
17 AIR EMBOLISM		
18 NITROGEN NARCOSIS		
19 DECOMPRESSION SICKNESS (BENDS)		
20 NEAR DROWNING		
21 MARINE ANIMAL INJURY		
22 OXYGEN TOXICITY		
23 CARBON DIOXIDE TOXICITY		
24 CARBON MONOXIDE TOXICITY		
25 DYSBARIC OSTEOCROSIS (BONERS)		
26 ANY OTHER DIVING INCIDENT		

I CERTIFY THAT THE ABOVE INFORMATION IS TRUE AND COMPLETE TO THE BEST OF MY KNOWLEDGE.

DATE

SIGNED

a 12 minute run and you can repeat it as often as you like.

### Hypertension

One worrying thing in Australia is that an awful lot of young men, the 19 year olds, have a blood pressure of 160 to 190 over 70. I put that down to anxiety, excitement etc., and so I do not knock them back if the diastolic is around 70. I think that the stress of "Am I going to pass this medical or not?" puts up their blood pressure, and so I ignore the high systolic. It is a rather pragmatic attitude, adopted because otherwise I would be trying to explain to very healthy young men why they should not dive, when I can not think of an adequate reason. With people who have a raised diastolic. I take a different approach.

### FITNESS TO DIVE

I think that only those with my absolute contraindication to dive should be told "No, you should not dive". They must be given the reasons. Everyone else can be told, "You probably should not dive, but this is a way around your problem". One can educate people who have trouble with their ears to clear them more easily. Pregnant women can be told to stop diving while pregnant.

I have given you a Knight's eye view of diving medicals. The floor (and the correspondence column of the SPUMS Journal) is open for everybody else's views on diving medicals.

### REFERENCES

1. Australian medical standards for workers in compressed air. *SPUMS J.* Oct-Dec 1981; 11(4): 13-17.
2. Wilkins P. US Air Force experiences with screening for coronary artery disease in flyers. *SPUMS J.* April-June 1982; 12(2): 9-11.
3. Medical Examination of commercial divers in the United Kingdom. *SPUMS J.* Oct-Dec 1981; 11(4): 17-19.

Dr Ian Unsworth

I would agree with almost all of what you have said, particularly about audiograms. Aural barotrauma is very common with people who are trying to dive. They are the ones who have not been taught to clear their ears, or they have stuffed up Eustachian tubes. It is helpful to have a baseline audiogram, if as one hopes, these people come back to you and do not go to their General Practitioners. Doctors without diving medical knowledge often diagnose ear infection and put them on antibiotics, not recognising that the eardrum has been stretched and that is what the pain and infection is due to.

Dr Fred Bove

When I was working on the east coast in the US, the university ran a scuba course. We did audiograms for all the students as a medico-legal device just in case the student came back and said that he lost his hearing during the scuba course. It was a curriculum course and there could have been a problem with them suing the school. I wonder how useful the baseline audiogram is in a random population that might turn up in a dive shop for a scuba course and then disperse themselves all over the countryside. That baseline audiogram is unobtainable when they are in a totally different area. In the US we would not do an audiogram on a normal candidate for a scuba course, except when there is a medico-legal problem, such as an institution that would worry about lawsuits. It does not seem to be a major problem in follow up. If somebody comes in with an ear squeeze and says "I cannot hear well" then one can diagnose for the decrease in hearing and treat him and see how he goes. We do audiograms in selected populations rather than in everybody, except for the military and professionals.

It is my understanding that small subpleural blebs are very hard to detect on a \$30.00 X-ray and that radiologists would not be able to rule out the presence of blebs on an X-ray unless they took special views. I still wonder whether the ability of an X-ray to pick up a small sub-pleural cyst is worth the irradiation and cost, or whether we should be more selective about whom we X-ray.

I personally am a little more liberal in doing stress ECGs in the older population. In the individual who is asymptomatic one must be careful to make sure that he is not asymptomatic because he never does anything. A person can be asymptomatic because he has been sitting behind a desk for 25 years and has never walked fast in that time. I would be careful when taking the history to make sure, when a person said that he has never had any symptoms, that he had had the opportunity to elicit symptoms in the past.

I agree about the young person with the high systolic pressure. I feel that they get a little excited and their systolic pressure goes up. However, in the younger population, the beginnings of hypertension are based on a high cardiac output, so I have those people come back after a couple of months, when the diving physical is not of concern, just to have their blood pressure taken.

The Harvard Step Test was used for a while in the late forties and fifties to test fitness. I cannot tell you precisely what level of conditioning it tests for. People were not so meticulous about relating VO<sub>2</sub> max to the exercise level when the Harvard Step Test was designed. In 1967, or 1968, we did some work using a Harvard Step Test on divers, which was published in the Archives of Environmental Medicine in the United States. We found that about half the divers in a scuba club did not pass the test. So we gave them a swimming programme. When they came back after three months they did pass the step test. It is a bit antiquated, but it is still useful for looking

at somebody's fitness level. It is easy to do, a watch and an old chair are all you need. However, there are problems with very tall and very short people.

Dr Ian Unsworth

Is it a dangerous test, like running somebody around the block?

Dr Fred Bove

This problem comes up all the time. We used to do a Masters test supervised by a nurse. A physician was not used because we did not have an ECG during exercise so there was no way to make judgement of ischaemia. I think one had to be careful doing an exercise test on an individual. One can be pretty certain by history. The US Airforce study looked at risk factors. They found that if the person had a certain number of risk factors, then they would be more likely to have positive stress tests that would point to coronary disease. In the older population, the over 40's, ask about diabetes or diabetes in the family, about high cholesterol, look at the person's weight, height and blood pressure and level of fitness and family history of coronary disease. If they have a lot of risks, or a history suggestive of cardiac ischaemia, I would not do any kind of exercise tests without ECG monitoring. On the other hand, if you get somebody who is relatively active, maybe plays golf twice a week and does some swimming, then I think you can go ahead with something like the Harvard Step Test which is reasonably easy to conduct. In fact, we do not do Harvard Step Tests, and I would only do a stress test if I thought it was needed.

Question

Should the physician attempt any sort of psychiatric evaluation, or should that be left to the diving instructor?

Dr Fred Bove

One of the most important things one can do is to find out if the candidate is taking drugs. Especially if they are young. There are a lot of kids on drugs who think scuba diving is another kick. There are a lot of kids who are on drugs and want to scuba dive for a sport. I will not clear anyone who is using marijuana or anything worse. These people will take the drugs when they are diving, which will cause them to do strange things. That I think, that one thing, is the most important psychiatric component. I agree that most doctors do not do a psychiatric assessment. I guess a diving psychiatrist does not listen to the heart.

Dr Ian Unsworth

I agree with you about drugs. That was the point of my presentation about the chap who got bent while taking drugs. I am sure many of you have seen people who wanted to take up diving and had been on the hard drugs. Has anyone admitted to anyone that they have been on heroin? I know that a lot of them drink, but in Australia we do not, as yet, classify alcohol as a drug.

I have seen two who admitted to having had heroin. There was a third, a girl who started to be very ill while I was seeing her. She went over to the sink and vomited and vomited and vomited. She was really crook. Her boyfriend had forced her to have the heroin before she came. We have to look out more and more for this. A lot of divers are getting away with drugs but for how much longer?

Question:

What age do you think people should start diving? I think in New South Wales 15 is the age, and some schools will take them at 14 if the parents dive. Do you think there are any contraindications to diving earlier than 14?

Dr Janene Mannerheim

I think they have to be sensible enough to understand the theory and large enough to be able to carry a tank.

Dr Fred Bove

I recently wrote an article in Skindiver about age and diving. In the United States the instructor organisations set 15 as a limit for certification. However they will train younger children that they feel are trainable. Say a 12 year old who is big enough to carry a tank around and who can learn. But they will not certify them. They give them an interim certificate that they have to dive with an adult. Then at age 15 they will automatically give them certification. I have a friend in the East, a very active Scuba Instructor, who trained his son to dive at age nine. He had his son diving with him in the Atlantic at age nine, in full wetsuit. Before I wrote that article I went to talk to his son, who is now 30 and assistant manager of his father's dive shop. He has continued to dive all the time and has never had any problems. So you can go below 12 or 13 with special circumstances and a lot of supervision.

Question

How can you persuade the instructors to get their pupils to go to diving doctors or to take notice of the advice given?

Bob Cumberland (Diving Instructor, Melbourne)

We give our students a list of recognized diving doctors. We consult with those people we know in the diving medical field before we issue such a list. We very strongly advise them to go along and have a proper diving medical. Some people do get knocked back and that only reinforces what we are already saying to our students, and reinforce in their minds the importance of the medical.

Dr Fred Bove

In the United States, all instructor organisations have medical directors. They all have a doctor as an official member who represents the medical interests of the instructor organisation. In my experience, the instructors have always wanted to have information about fitness for diving, in addition to better information on diving medicine.

In the United States, for the most part, the doctors that know about diving medicine try to relate with the instructors in their community and get together in seminars and consult over the phone. If you can establish that kind of environment, you will not run into this kind of problem.

Dr Ian Unsworth

The situation in Sydney is not so good as in Melbourne. I am aware that one or two of the bigger dive shops are only too happy to ask the students to go to see their own general practitioner. I think they do this because they are going to get fewer knockbacks because diving instructors are aware that general practitioners may not be so on the ball. I think the conscientious diving instructors are happy to have weak students weeded out before problems occur.

Dr Fred Bove

Has anyone tried to inject diving medicine into the medical schools? We have tried and it seems almost impossible. Occasionally we can squeeze an hour of diving medicine into the medical course.

Dr Ian Unsworth

I think we must get things in proportion. The course costs \$200 and the medical about \$60 and lasts for quite a long time. Not a bad comparison really.

Unidentified Speaker

When I did the course in Sydney I was told "You can go along to the Diving Medical Centre, but it is inconvenient to go over there, and it is not rebatable. Go and see your local GP as you are a young, fit character, and you should not have any trouble." It is really up to us to liaise with instructors and to get into the dive shop scene.

Dr Ian Unsworth

I think that in Sydney there are sufficient diving doctors for there to be no problems.

Dr Janene Mannerheim

The important thing is to educate the diving schools and instructors to get people to have their diving medicals before they start. I have people turning up for diving medicals the night before their check out dive. I fail up to three out of ten. The need is for education of instructors.

Dr David Clinton-Baker

Diving doctors have got to show that they can offer something more than the ordinary doctor can give in that they are not just there to turn down people, but are also there to give sympathetic and recent advice in a specialized topic. Look at the effect that Tony Slark has had in New Zealand. He permeates the whole diving world. I often feel sorry for Tony, because he gets pestered so much. He always has been willing to give advice at any time.

Unidentified Speaker

We have been talking about instructors and divers being accredited. The other side is dive groups and dive clubs. Reaching these people depends on the initiative of the diving doctors in that community. The differences between Melbourne and Sydney could be partly attributed to this. Just a visit to a dive club meeting and a short talk about decompression sickness to people who did the course 15 years ago is quite valuable and really does change their attitude towards diving and towards safety aspects.

Bob Cumberland

We are finding problems with a number of older, over 45's, who are passed as being medically fit. They pass their swim tests without any problems. Some of them have played a lot of water polo in their youth. But when they are placed under any sort of stress, they become very, very anxious about the skill they are trying to perform. They invariably fail the course because they just do not seem to have the stamina. But I do not think that is quite accurate. I think they are so anxious about what they are doing that they cannot really adjust to the underwater environment. Even though we handle them with kid gloves, we have a lot of difficulty getting them through. Men or woman who learnt to dive in their 20's, 30's or 40's are not a problem generally speaking. It is the older person wanting to learn to dive who seems to me to find it very, very difficult. They are trying to learn to dive with a group that is 20 odd years younger than them. I would be interested to hear some comments.

Dr Fred Bove

That is an extremely important problem. I have suggested that in our university courses that we do not make the older adults (50's and 60's) learn with the college students. The younger kids can learn skills much more rapidly. Unfortunately as we get older our ability to learn dexterity skills goes down. I think the answer to that is to have courses for older adults that are not run at the same pace as a course for the younger kids. One may have to charge more for it. One may have to run it for an extra four or five weeks. The answer is to change the pace of the course, and not have middle aged adults trying to keep up to the pace of late teenagers or young adults. One must tailor the course to the people.

Dr Harvey Chesterfield-Evans

I did exactly what you have described five years ago when I was 55. I did a course at Heron Island, but did not have enough underwater time, so I did another course in New South Wales. The senior diver may be slower with dexterity skills, but one feels that as you have been around a while you will let yourself down if you cannot keep up with the others. So you tend to rush yourself, because you want to make sure that you can keep up with these people who are the same age as your children. There is some pride involved, quite apart from physiology.

As far as a two tiered type of training is concerned, I believe that if you cannot do the course as it is laid down, you should either get fitter, or take up squash or something.

Dr Fred Bove

It is not a matter of "cannot do it". The skills take a little longer to learn. They have to be repeated three or four times instead of two or three times which are enough when one is a little younger. I am not suggesting compromising the training. What has to be done is to slow it down a little, repeating things a little more so that the person who does not have the ability to pick things up rapidly can pick them up over an extra week or so. At the university we ran a continuing education course, which was mostly adults, at that pace. The undergraduate course usually finished four weeks sooner. We ran a fourteen week course, but the undergraduates were done in ten weeks. They were all just as well qualified.

Dr Ian Unsworth

Does anyone think there is any alternative to a person who is judged 'not fit to dive' and a person who is judged 'fit to dive, unlimited'? Dr Bove was talking about this earlier on, and stated 'you are either fit to dive or you are not'. There is no qualification there. Is there a general consensus about putting restrictions on a person's diving?

Dr Fred Bove

I think it is a very good idea to have restrictions, but how can you enforce them? In the States we do not really have much to do with the candidate. He turns up in your office with a form. It has a very cursory physical examination sheet that has to be filled in. All you have to do is tick in a couple of boxes and sign it. That can be done by any physician. There are instruction paragraphs about ears and asthma and things like that on the form so that the physician knows what to ask.

In the United States one gets a card that says 'certified scuba diver'. There is no statement about how deep or where they can dive, when they can dive, or who they have to dive with. The card says 'scuba diver'. Now there are some cards that are more advanced. You can do advanced diving, wreck diving, photography, cave diving, and so on. The fundamental card basically says 'certified scuba diver' and that is all. If an individual is interested enough to come to somebody who knows about diving medicine, then one can advise that person about what to do, one can give him a written statement. But there is no legal or official way that one can enforce it.

Dr John Knight

I think this idea owes a lot to Tony Slark. He says that the doctor is there to advise the diver about any limitations that the diver should place on his diving in order to be safe. For some no limitations. For others you think it would be wise to restrict their ascent rate to 20 feet a minute. For somebody who is not awfully fit, it could be dangerous because he would get very breathless, and be unable to

cope, if he goes diving on a day when he might be caught in a current. If you feel that someone is not very safe or happy in the water, a sensible restriction would be "If the weather is rough, forget about the dive, do not go into the water, even if you have driven 80 miles, because you are not very happy in the water, you may get into difficulties on the surface". Most of the fatalities occur on the surface.

I put "Ascent rate limited to 20 feet a minute" on the certificate when a person has a history of asthma but has not had asthma for 20 years. I also put it if he has a low Vital Capacity/FEV ratio. I explain why I have put it and hopefully he will look at his watch and depth gauge and come up somewhere around 30 to 40 feet per minute instead of around 60 or 80. Very few people come up at 60 feet per minute.

I am all in favour of explaining to the candidate anything that would be dangerous for him and how to try and avoid trouble. If he does not want to avoid trouble, it is his life he is playing with. I think our job is to give advice. I think that telling anybody that he should never dive, except for that row of absolute contraindications, is very difficult to justify because I know people who do dive quite safely with all those conditions. I would like to ask Bob Cumberland if he is happy to have students upon whom a diving doctor (not a GP) has put restrictions?

Bob Cumberland

Obviously, we are not as happy as if the person was completely cleared to dive. There is a danger of buddying up someone who can ascend at a normal rate or 50 to 60 feet per minute, with a person who knows that he should not ascend at that rate. Something may occur. If you are aware of it, during the course you can probably do something to control his ascent rate. But after they leave our care, no one knows what will happen. A lot of people become disorientated under water, particularly inexperienced divers. People have little idea of their ascent rate. Often with buoyancy vests they come up like missiles.

Unidentified Speaker

I think a problem with your restrictions is that you are examining the patients before they start diving. They really have no background to understand what you are trying to put across.

Dr John Knight

Hopefully, your explanation is something that they will remember. You give them two pieces of paper saying they are fit to dive under the following conditions. One is to give to the dive shop, and one is for them to keep, in the hope that they will perhaps look at it once or twice. People do forget things, and we cannot control their actions at all. All we can do is offer advice.

Dr Peter McCartney

For whose benefit are you writing the conditions?

Dr John Knight

They are an attempt to do what is best for the patient.

Dr Ian Unsworth

There are other restrictions besides ascent rates. The number of dives per day, repetitive dives, depth, decompression or no decompression, all can be mentioned. One is trying to get them to dive safely. We are trying to get them into the water, but not at the expense of their lives or a buddy or two.

Restrictions do not have to be bad. Somebody who is not terribly fit may well be very pleased to have this backup because they can say to their buddy "I am recommended to only do one dive a day", and that is probably all he feels like doing anyway. These recommendations are to me the best argument why these people should be seeing a diving doctor.

Dr John Knight

The happiest bloke I have ever seen after a diving medical was a man of 60 who I told that he really should not dive. His sons (18 and 20) were both doing diving courses and they wanted Dad to go along. Dad did not mind being in the boat waiting for them to come back, but he did not like being in the water. He was only too thankful, when he had blown into the vitalograph and produced an almost flat curve, to be told that he should not dive.

Unidentified Speaker

One of the areas you have not touched on is the transport of a very sick or injured diver. Transport of a bent diver presents some problems.

Dr Ian Unsworth

There are only two ways to transport someone, by air or land. To move a patient from Wollongong to Sydney it is probably quicker by helicopter if you have a helicopter immediately on standby. I am prepared to accept that helicopter vibration is acceptable until proven otherwise. So, if you have a helicopter immediately available, that would be the method of transport. But if you have to call a helicopter down from Sydney, and you have a road ambulance available, the ambulance may be preferable because it will save time. The road between Wollongong and Sydney is quite good now. It is not speed, but a really steady drive that is more important than speed. Under those circumstances, use an ambulance, with intravenous fluids and 100% oxygen.

Dr Fred Bove

One has to get the patient relatively stable, and get him to definitive medical support as soon as one can. The commercial diving industry follows the basic rule that if you have a sick diver, you can put him in helicopter and fly him to a chamber if you do not have one. Most of them

have a chamber on site. If they have to recompress a bent diver who is having seizures and there is no doctor there, the best thing they can do is to get the diving supervisor to put up an IV and give the drugs that they have got and wait for a physician to arrive. In the North Sea they have one man compression chambers that can be transported by helicopter and mated onto bigger chambers so they can transport under pressure.

The problem with any remote site accident or injury is that you are pretty well stuck with having to arrange transportation. You would not want to wait for a physician to arrive on the boat before starting treatment. I do not think it is possible to be ready for every contingency that one could consider needing treatment in a remote place. At some point you would have to decide which ones you are willing to take care of on site and which ones you are going to have to transport the patient. The ideal solution would be to have a fully equipped small hospital with a rotor on top of it to go anywhere you wanted it to, taking a doctor, two nurses and a paramedic in it. Short of that you will have to transport the patient sometimes.

Dr John Doncaster

We must make allowances for people's practice and also for the conditions under which they dive. In Victoria, where I go diving once, twice or three times a month throughout the year, it is certainly hard work. It is always cold, even in summer. One really does need to be moderately fit to cope with that. The kind of stuff I do often involves a surface swim, and there is a big difference between that and dropping over the side of a boat and hopefully, not encountering any wild currents, but knowing that, even if one does, one could come to the surface and be picked up. There is a huge difference between the sort of diving we are doing in Madang and diving in the cold waters of southern Victoria. I expect that Bob Cumberland would say that everyone should be trained to cope with Victorian conditions and Madang is just a luxury. But there are a lot of people who only dive in calm, warm waters. What should we do about them?

Dr Ian Unsworth

I think they would elect not to dive in Victorian water. Some people dive once a year.

Dr John Doncaster

Are they safe to be let loose once a year?

Dr Ian Unsworth

I think we can stand by our record, as politicians say. We have yet to lose a member of SPUMS.

Dr John Doncaster

Is that good enough? I feel that for our next meeting we should have an incident report form to be filled in anonymously. It would be interesting to see how often people have close shaves, including such things as dropping

a weight belt and ascending inadvertently.

Dr Mace Ramsay

I think that might well prove a point we have missed. We talk about fitness, but the whole psychological approach comes into this as well. It seems we have a fairly intelligent, probably rational group of divers. I think the incidents have been a lot fewer than one would have expected in an ordinary group of divers of similar experience and physical condition over a period of a week. However we have been lucky. What would have happened if a rain shower had come across while we were in the current? We would be easier to spot if people stopped wearing all blue and black. The British Sub-Aqua Club put that out years ago. I wonder if diving with such large groups is not asking for trouble.

Dr Fred Bove

Several of us who run physical training courses and diving together, have found that there are certain things that are worthwhile. It is sometimes worthwhile to hold a group meeting daily, or at the end of the course to find out what little things have happened. From that you can get some recommendations for the next year on how to avoid ear squeeze, or how to avoid external otitis. Just keeping a record of what ear squeezes occur and things like that is worthwhile so that one can advise the next course how to avoid it.

Diving in a group like this we, in a sense, pressure each other to dive well. For example in the Caribbean, the local dive shop runs a boat that takes on all comers. They sit there until thirty divers appear on that boat from anywhere. The diving off the boat is horrendous. Some divers jump off the boat and disappear into the blue and nobody knows where they went. Some diver jumps off the boat and all his gear comes off, and he flounders around. It really is a disaster to watch them. A group like this, who are basically committed to training each other and watching each other all the time, and putting on a little bit of peer pressure to dive properly and who have all the gear right is one of the best ways to dive. I have had comments from people who come to our course that, they would not want to go on another diving holiday or diving expedition because they did not feel secure enough. When everybody has the same level of knowledge and the same level of concern the diving is done much better.

Dr Bruce Bassett

I would endorse from my own experience what Fred has said. With each group the first lecture is on diving safety, which is what you do. I think it is worthwhile before starting the diving to re-emphasise some safety tips. A lot of people are uncomfortable diving with large groups. In the Caribbean we have 18 to 20 people on a boat, but the diving is superbly organised. Weight belts are taken, tanks are taken, so that we are diving as easy and safe as anywhere. In spite of the numbers it is still good diving, because we are spread out. If one gets into current or drift diving, that has got to be super-organised.

Dr John Knight

SPUMS has come a long way since we went to Truk, which was the first time that we insisted that people had buoyancy compensators. On the first dive people disappeared as their nine weights, without a wetsuit, took them remorselessly towards the bottom. Somebody turned on his Fenzy when this happened to him. He blew up his Fenzy very nicely, but he unfortunately did not turn it off nor let the air out of it. Those things no longer happen. The people who have come back time and time again have improved their level of skills.

There was an appalling series of people running out of air underwater in Truk. Five in ten days were brought to the surface on octopuses. When this was discussed in the meeting one doctor said "But every diver runs out of air at least once a year". That attitude, mercifully, has died and gone away.

I think SPUMS is, for a large group, remarkable safe divers. But we do take chances. Not every boat had a safety line when we were diving in that current. They should have been behind every boat. They were not there because there was no rope in some boats. If rain had come there would have been some very worried people. But we can all float in our compensators, put our snorkels in our mouths, and make sure that we get air to breathe.

This is the sort of thing that is being taught in the diving schools now. What to do when you lose contact with the boat, whereas five years ago that was not done. It was assumed that one would not lose contact with the boat so there was no need to tell the pupils. We are developing a more intelligent attitude. We have not been as safety conscious as we should have been.

Bob Cumberland

In Victoria we do a lot of current diving, which is very exciting diving. What we could have done was to drop a group at a time in the current, with a surface marker buoy attached to one of the divers. They would have flown along that face and it would have been a very exciting and very easy dive. It is a simple matter for everyone to ascend on the line to be picked up by the bat. Most of us have never dived this area before so we are not quite sure what to expect. It is a valid comment, and perhaps we could bear it in mind for the future. As a dive guide here I have been very pleased with the attitude of everyone and the way in which they have conducted their diving. Apart from tanks falling through backpacks, I cannot think of any problem except for sorting our tank straps.

Quentin Bennett

The comment has been made that we should be diving with orange compensators, etc. That is another part of the education of divers.

I have done some work on this, and the colours must be fluorescent. The clearer and bluer the water the redder the

colour of the fluorescent material must be. If you are working in very greenwater, you would be best wearing white luminous tape that shows up pretty well in the water.

Bob Cumberland

I spend a lot of time looking out for divers bobbing up here, there and everywhere. Invariably, because of the reflection of light on the surface of the water, all divers, no matter what they are wearing, appear, at any distance, as black blobs. You cannot distinguish any colour, even if they are wearing a brightly coloured wetsuit, until you are close. In my experience divers are little black blobs when they surface, hopefully not too far away.

Dr Ray Leitch

We have a check list at the end of every dive that includes depth and time. It would be simple to add "Did you have any problems, if so give a report". I find I tend to forget things by the next day.

## MIGRAINE, HEADACHES AND DIVING

Rosalind Lloyd-Williams

I have had migraines since I was about 16 and I think I am qualified to discuss it from a patient's point of view, as well as the doctor's.

Migraine has been defined as a unilateral episodic headache.

Many migraine patients often have a prodromal period lasting for 24 to 48 hours before the onset of the headache. Mood changes, appetite changes, urinary or bowel symptoms allow some people to predict when they are about to have an attack. Symptoms associated with migraines are unilateral, thumping headaches, unilateral nasal stuffiness, runny eyes, scalp tenderness, neck pain, nausea, vomiting, diarrhoea and for some, diuresis. Migraines occur in about 10% of the population, but are more common in females by about 3 to 1. However, they are more common in boys than in girls until puberty. Migraine starts early in life. Even a two year old child can have a headache of the migraine type. Children often have abdominal migraine, which then goes on to be the adult common migraine. The point is that 5% to 10% of fit young people who may present to you for diving medicals can be migraine sufferers.

The cause still remains unknown despite wide research. It is terribly difficult to bring on attacks experimentally. In divers it has been found that in deep diving, platelet counts fall, clumping increases and there is an increase in certain enzymes suggesting an increase in metabolic activity, similar to that in the post-traumatic condition, as the diver is coming up. It is the same sort of general inflammatory type of reaction that Fred Bove discussed in relation to the treatment of decompression sickness (see SPUMS Journal, July to September 1982). It is postulated that the divers have some altered vascular chemistry in the frontal area and that these changes are most likely to occur there first. Possibly air bubble formation is a factor.

There are various factors which can trigger a migraine in a susceptible patient. They can differ from time to time in each individual. Changes in blood sugar, either up or down, can cause it. So can changes in sleep, either too much or too little, also dietary factors such as red wine, chocolate, oranges and so on. Tyramine has been postulated to be a factor. Migraine sufferers are very susceptible to glare. Excitement, especially in children, effort and exercise, noise and smells have all provoked migraine. There was a case of a man who only got a migraine when he smelled a certain food. Hormonal factors, especially premenstrual factors in women, precipitate migraine. However, it very rarely occurs in pregnancy.

Cold has been postulated as a factor, but there is no real evidence for this. Migraine sufferers are often told to wear wetsuits with hoods to prevent cold. However, during an attack, cold packs to the head can be a great help. Stress can cause it, but migraine occurs after a stress not during it. There is classic 'weekend' or 'relaxation' migraine. I suppose it depends whether one looks at diving as a relaxation or a stress, whether migraine is likely to be precipitated for that particular individual. A fall in atmospheric pressure has been shown to precipitate migraine.

There are very few references to migraine sufferers and diving. However, in 1965 Anderson in "Neurology" published a paper about when migraine sufferers were decompressed from a hyperbaric environment or subjected to a fall in barometric pressure during high altitude flying. They frequently got attacks of headache and visual disturbance. Migraine patients are more likely than others to get headaches when they undergo barometric pressure changes. In the study of four people in a chamber which went down from 66 feet to 135 feet all these patients had headache and an abnormal EEG. Two were 'classical' migraine sufferers, and one 'common' migraine sufferer.

When you are presented with a diver with a headache, there are quite a few things to help you. You have the history of attacks, the recurrent nature of the attacks, and the family history quite often. There is a simple test that has been published in "Headache" in 1981, which tests for vascular dilatation headaches. Vascular dilatation headache improves during a Valsalva manoeuvre and then worsens within two to five seconds afterwards, and is back to the normal level of headache in 15 to 30 seconds. The second part of the test is the Valsalva manoeuvre plus compression of the superficial temporal artery. The pain improves during straining and increases at the end of the strain in external carotid system dilatation which is what happens with migraine.

The differential diagnosis is important with divers. The main thing we have to worry about is confusion with decompression sickness which normally responds to recompression. Migraine does not. Delirium and confusion are not connected with migraine. Other headaches are hangovers, trigeminal neuralgia, cold induced headaches and CO<sub>2</sub> induced headaches which are usually fairly easily diagnosed.

Back to deciding fitness to dive. Migraine patients are barred from professional and decompression diving in the United States and I presume also in Australia. The hazards of migraine underwater are that a large proportion of migraine patients have impaired vestibular function and quite often there is a benign recurrence of vertigo during the attack. There is likely to be vomiting with migraine.