

SPUMS SCIENTIFIC CONFERENCE 1982

AN APPROACH TO MEDICAL EVALUATION OF  
THE SPORT DIVER

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A thorough history and physical examination with attention to problems specific for diving should be adequate in 80-85% of candidates. The remainder require individual attention and laboratory studies tailored to the questions to be answered.

You can make the decision about diving in most candidates based only on the physical examination. With a benign history and normal lung examination, a chest X-ray will add little. But a chest X-ray is helpful if there is concern from either the history or the physical examination.

Long bone X-rays in sport divers are of no value since there are no reports of bone problems in scuba divers. Bone lesions from diving are associated only with some commercial diving exposures.

Divers in poor physical condition, and those over the age of 40 who do not exercise, should have a stress ECG done up to a level of 10 - 12 mets to be sure they can tolerate the expected exercise needs in diving, and to rule out occult coronary artery disease, or exercise induced arrhythmias.

You will rarely need a blood test in a normal person, and should do the tests indicated when an abnormality appears in history or physical examination.

Note that the above is directed to the sport scuba diver who can elect to dive in a suitable, safe environment. The physical standards for commercial diving are more stringent, and have been written into regulations in some countries.

I told you that US Navy divers are usually fit and are encouraged to maintain fitness throughout their careers. This is done at the expense of their work time. The fitness schedule is part of the working day. In the United States, a lot of corporations are doing this now too. They are providing fitness and maintenance times in the working day so that the people who work for them can take an hour off a day to go to a fitness centre and maintain fitness. There is some validity for doing this.

I do not think one has to do extensive evaluation of everybody. There has to be some flexible approach to the individuals that want to dive. When examining freshmen in college Phys Ed who are taking a scuba course as part of their aquatic programme, I do not think it is reasonable to ask for blood tests, audiograms, chest X-rays and electrocardiograms on all those kids. If some have a history of rheumatic fever, then they will have to be dealt with differently from the rest of the group. The majority of younger individuals who want to take a scuba programme can be dealt with by a thorough physical exam, with diving

allowed if it is totally benign. If there is something in the history about asthma, or a heart problem, then they can be selected out for a possible further testing, tailored to the individual's problem. There is no evidence to date that sports divers get aseptic bone necrosis. I do not think that one can justify the expense or the radiation exposure of bone X-rays for sports divers.

We are going to continue for three more sessions on specific approaches to various and sundry kinds of medical problems to try and get some feel for who can be let do a diving programme and who cannot because of some underlying illness. This is only for sports divers. Commercial diving usually will not accept anybody who has serious underlying medical disorders, or a history of asthma or lung disease, or heart disease. They just will not accept them. They want healthy, fit individuals to train and put into commercial diving. We are sliding away from that hard, rigid rule in the sport diving community because it is a sport. It should be available to more than just the super people of the world who are fit, healthy and have no past illness. I hope, over the next couple of days, to pass on some guidelines where to draw the line where sport diving is not available to some people, and when you can allow people, who seem to have some abnormality, into the sport.

Dr Ian Unsworth

You said that there is no evidence to suggest that sports divers get dysbaric osteonecrosis. I have evidence that sports divers do get dysbaric osteonecrosis. There is no reason why they should not because they often dive deeper, more frequently, with less attention to tables than commercial divers who are far better monitored and regulated. The only difference between the sport diver and the commercial diver is the fact that one is paid. Bubbles do not know that.

Dr Fred Bove

There are millions of sport divers in this world, and the great percentage of them do not go to extremes. In fact, a lot of them do not dive. Of the ones that do dive, I would say that the majority of them do not go to extremes. The aberrant divers who disregard the rules, perhaps they will get aseptic bone necrosis but the diver that is diving in the normal fashion, the way he is trained to dive, should not get aseptic bone necrosis.

The second point is that if we take whatever the number is of sports divers, there is a finite incidence of bone necrosis in that population, regardless of what they do. One cannot statistically justify a statement that sports divers get aseptic bone necrosis because some sport divers have aseptic bone necrosis. One has to do a fairly complex statistical analysis that eliminates the normal incidence of the disease in the population first. As far as I know, that has not been done. There is really no firm evidence that sports divers are prone to, or get, aseptic bone necrosis. From that statement, I do not think it is justified to give all sports divers bone X-rays. It is the same argument for doing IVPs on all hypertensives.

The cost of the X-ray exposure does not warrant the benefits to be gained from X-raying all sports divers.

Dr Ian Unsworth

I accept that totally. I am not an avid advocate of bone X-rays for sports divers either. However, we do know that dives within the tables may produce some degree of venous gas emboli. If we accept that these may be the essential aetiology of bone change, then perhaps we ought to change our view, and say that sports divers may be susceptible to dysbaric osteonecrosis. The problem is that sports divers are not investigated for this. Perhaps we should be taking samples of sports divers and have a look at that bone.

Dr Fred Bove

I agree that we ought to do some study. The best way to know what you are doing is to get intelligent information and use it intelligently. It would be nice to have bone scans. We have learned in exercise physiology that when somebody has pain somewhere, the bone may look perfectly normal on X-ray, but when one does a scan, there is a stress fracture. The hyperaemia of the stress fracture may show up on scan, but an early fracture will not show up on X-ray. If the problem is under perfusion of a section of bone because of bubbles, then the chances are that we would find that on a scan and obviously not find it on an X-ray during the acute period. Denis Walder in England has done some work which shows that some divers who are bent have abnormal scans when studied soon after their exposure. It would be nice somewhere to generate some funds to do X-rays in some sports divers and to do bone scans in some sports divers, perhaps only in the ones that get bent, to find out what happens.

## MEDICAL EVALUATION OF THE SPORTS DIVER

AA Bove

### GENERAL REQUIREMENTS

The physician who evaluates candidates for sport diving should be familiar with diving physiology, the subsea environment in which the diver works, and the physiological responses of the body to cold, exercise and pressure. With this background, a diving candidate can be properly assessed and the correct decision made even in cases where a diving candidate may have a chronic disease. One way to determine how a diver will respond to diving with some chronic illness, is to consider how the illness will be affected by exercise, pressure, cold and emotional stress.

I have addressed exercise previously. A candidate with chronic illness should be able to meet the requirements of

exercise that I outlined. If these requirements are not met, then either the candidate should not be approved, or should be considered a special problem requiring added support during diving. An example of the latter is a physically handicapped person (an amputee or a paraplegic, but not from DCS) who might dive with other handicapped divers in highly supervised programmes. Exercise capacity need not be guaranteed in all diver candidates. The individual between 16 and 35 years old who is physically fit, and by history has good exercise tolerance, usually poses no problem. Persons in this age group who are poorly conditioned, and most candidates over 40 years old, should have an exercise evaluation prior to diving. In addition, persons with chronic illness or history of chronic heart or lung disease can be exercise tested when there is doubt about their exercise capacity.

The effects of pressure which must be considered are chiefly those due to Boyle's Law (a good review of these pressure-volume relations in diving is worthwhile). Inability to equalize middle ear pressure, a chronically perforated ear drum, history of spontaneous pneumothorax and evidence of lung blebs on X-ray are all contraindications to diving. There is at present some controversy about diving after thoracic surgery. The great number of coronary bypass operations in the US have generated a group of divers who have had chest surgery. My personal experience with four or five of these patients is positive. They had no problem from the chest surgery per se. Their major problem is exercise capacity, and this can be adequately tested.

Another important and controversial area is allergic asthma. Patients with clinical evidence of airway obstruction at rest or with exposure to cold, or during exercise should be disqualified because of the high risk of pulmonary barotrauma. Patients requiring drugs for asthma control likewise should not dive. A history of asthma long past, with four or five symptom free years, no wheezing and no drug therapy, is probably not a contraindication to diving. However, one must examine carefully to be sure that no airway obstruction exists. Pulmonary function studies will help document the state of airway resistance. However their greatest use will be when you need objective data to support a disqualification. It is less common to need pulmonary function studies to document normality.

Although cold stress is not commonly considered in qualifications, there are several problems which need to be considered. Cold induced asthma was mentioned above. Breathing cold gas from a scuba bottle can have the same effect as breathing cold atmospheric air. If cold air induces asthma on land, it is likely to cause problems while diving. People with Raynaud's disease, ie. cold induced digital cyanosis, should not dive if the problem is uncontrolled since gangrenous fingers and toes may develop from the cold water exposure. Cold also induces a change in the circulation which adds a load to the heart. Persons with mild hypertension may have an excessive rise in blood