

PULMONARY DISORDERS AND DIVING

Dr Fred Bove

The conditions I have chosen to discuss are set out in Table 1.

TABLE 1

|                                  |                                |
|----------------------------------|--------------------------------|
| Asthma                           |                                |
| Pneumothorax                     | a. Traumatic<br>b. Spontaneous |
| Chronic obstructive lung disease |                                |
| Chest surgery                    |                                |

## ASTHMA

We have already had some discussion on this. The main problem, and I think the only problem, with asthma is the inability to adequately and rapidly empty the lungs, because of a chronic airway obstruction, partial or complete as the case may be. That is not good for the asthmatic anyhow. But it is much worse underwater, because on ascent, when you have to have a clear airway to get the gases out of the lungs, the bronchospasm or airway obstruction present can delay the emptying of a small segment of lung and cause pulmonary barotrauma and cerebral air embolism.

I hold that if a person has asthma and they are wheezing, they absolutely cannot dive. These people have chronic airway obstruction and should not dive. Occasionally in the Caribbean there is someone on the diving boat squirting down Isuprel and all set to go, wheezing to beat the band, with a regulator in his mouth. Some how or other these people do sneak through the system and get onto diving boats. They claim that their asthma is better out on the ocean because there is no pollen there. I am not sure that is a good excuse for diving as an asthmatic. Anybody who is apparently wheezing should not dive.

I think that anybody who has to have medication to control their asthma should not dive. If an individual requires chronic medication, he still has an unstable airway. The instability is to some extent suppressed, but either exercise induced asthma, which is not an uncommon problem, or cold induced asthma can result from the diving environment. Either of those things happening under water is a really dangerous problem, because acute asthma clearly causes some airway obstruction. There are some very poorly emptying lung segments are there is a high risk of air embolism.

So the wheezing asthmatic should not be allowed to dive. In fact, most drug controlled asthmatics still wheeze a little bit. They say that they are fine, and that they do not have any problems, but if you get them to exhale rapidly, your

stethoscope picks up scattered squeaks. That means that there is still some bronchospasm in some areas of the lung. It does not cause symptomatic problems, but it could certainly cause a problem while diving. Those two kinds of patients are not really a problem. Everybody agrees that you should not let them dive.

The patient who is a problem is the 22 year old male who tells you that he was an asthmatic up to the age of 12. From 12 years on the symptoms waned and by the time he was 15 he did not have asthma and was active in sports. He has never wheezed again, and is taking no drugs. Those patients are difficult, because some of these people do, in fact, get their asthma again. I would guess that they are all prone to it. We have had a run of very dry summers. During the second one I started to get a lot of athletes coming in with funny symptoms that they did not describe as asthma, but as a degradation of their performance that no one could explain. The history in these people was one of asthma as a child, which went away by mid teens. They then got active in sports in high school or college and did fine until this summer, when they began having trouble with their athletic ability. What they were getting was exercise induced asthma. But it was in a background of a high pollen count because of the very dry summer. A lot of these people have an underlying tendency to bronchial spasm with certain stimuli. The question is, will they get bronchial spasm while they are diving?

I do not have good answers to that question. There are a lot of these ex-asthmatics who do get cleared for diving. My approach is to ask the individual what he does for exercise and whether he has any limitations. Then make him breathe very hard, hyperventilate, and listen to his chest for any kind of wheezing. Also take a chest X-ray, to see if he has any hyperinflation. In these patients, it would be reasonable to get an exhalation chest X-ray too. By having a patient hyperventilate and then breathe out very rapidly I can often pick up a few scattered wheezes here and there, which suggest that there is still some bronchospasm.

If there are no wheezes and if I can convince myself that he can handle both cold and exercise without wheezing, I might approve diving. On the other hand, if one could demonstrate that there are clear cut tendencies to bronchospasm, under those circumstances then he should not dive.

A way out which seems to work with an asthmatic who one feels is going to be a problem, is to require a lung scan and pulmonary function studies. What one hopes to do is to demonstrate an abnormality. I do not think it is reasonable to do tests that one can predict will be normal. But if you are sure that the patient has an abnormality and you want to make sure that he or she understands that they should not be diving, then it is worthwhile having tests. I tell that person "I think you have asthma. I think you are going to have trouble diving. I think you have airway obstruction and I would like to demonstrate that by pulmonary function tests." Since pulmonary function tests are expensive,

about half the asthmatics do not come back and do not dive because it would cost too much. The other half will spend the money. What I end up doing is proving that they have a limiting abnormality and I can disqualify them. Of course some will go to some other physician. Now that they know what not to tell, they would hold back that part of their history and get cleared for diving. But at least I feel that the obligation that I have to make a person dive safely is handled.

To sum up. The wheezing asthmatic and the asthmatic on drugs should not dive. The asthmatic with a history in the remote past can be told pulmonary function studies, and even pulmonary function studies with exercise, are needed to make sure that he does not develop a bronchospastic response. If the individual agrees to go ahead with that, then if they come out normal then I think he should probably be allowed to dive. If they are abnormal, there is clear cut evidence that he should not be diving.

## PNEUMOTHORAX

As far as I am concerned, people can dive after a pneumothorax due to injury or surgery, if the lung is reinflated and there are no abnormal chest dynamics. With a traumatic pneumothorax there are usually a few adhesions, so the lung will not collapse completely. These individuals are not prone to spontaneous pneumothorax.

However, anybody with a spontaneous pneumothorax is prone to more of them. Most people do not understand the significance of that. They feel that a single spontaneous pneumothorax was something that just happened, and that it will not happen again. But it is very likely to happen again.

I remember having a long argument over the telephone with a dentist who had a physician friend who he got to sign off his medical. The dentist went to a diving instructor, a pretty astute guy, who looked at his medical form. He had written down 'spontaneous pneumothorax'. In fact that dentist had had three of them, two while playing tennis and one while working in his office. The diving instructor would not take him in the course. The dentist was ready to get a lawyer to force the instructor to take him in the course because his friend, the doctor, had said he was fit to dive. I often get these cases to referee. I talked to the dentist at length. I talked to his physician at length. His physician was totally ignorant of anything to do with diving medicine and in spite of this, had signed off the form, which is not an uncommon thing in the United States. I educated the doctor and sent him a xerox copy of a chapter in a diving medicine book. He then called the dentist and told him not to dive. He finally convinced him that if he was going to dive he was highly prone to another pneumothorax and so got the instructor off the hook.

I think spontaneous pneumothorax is an absolute contraindication to diving. However, during a diving

medicine course in the Caribbean, some chest surgeons said that there is a treatment. Strip away the pleura and cause a total pleural adhesion between the lung and the chest wall. The claim is that there are no more spontaneous pneumothoraces after this. A thoracic surgeon, who was a diver, asked whether people who have total adhesion of both lungs to the chest wall could dive. My answer is that I do not think they should dive. I have not met such a patient yet. It is not a common operation. Most people do not have the operation unless they have had recurrent multiple episodes that are causing severe life threatening problems. Somebody who has that problem will not, most of the time, want to do anything that will run the risk of another pneumothorax.

The few people I know who have had spontaneous pneumothoraces really do not like it. It is very unpleasant because it hits them anytime without any way of predicting it. Most of them do not like getting into situations where a pneumothorax is almost guaranteed, so they will not dive. Spontaneous pneumothorax still is a contraindication to diving. I guarantee that anyone who meets somebody like that who wants to dive is going to have a real argument on their hands. So one has to be ready with a nice, clear, logical argument to point out why it is dangerous to dive with a history of spontaneous pneumothorax.

If there is no history of spontaneous pneumothorax, is an X-ray necessary? I believe that a chest X-ray is only required if one needs to make certain decisions based on a chest X-ray. Then one has to make sure that the chest X-ray will provide the information to make those decisions. A plain chest X-ray is unlikely to show small blebs on the pleural surface, so that is not a good reason to take a chest X-ray. If one wants a chest X-ray to show big blebs, that is fine. Usually a patient with a big bleb, a great big hunk of the lung missing, has other chronic lung problems which one can pick up in a physical examination. Then a chest X-ray will verify the clinical impressions. I think the need for a chest X-ray ought to be decided by what is found on the history and physical examination. With a late teenager, adolescent or young adult college student, who is in good physical condition and who has a perfectly normal history and perfectly normal physical examination, it is highly unlikely that a chest X-ray will give any more information. I think doing a chest X-ray on all these people is a significant excess of both cost and radiation exposure. But with a good history and physical examination, one ought to be able to pick the individuals who need a chest X-ray.

## CHRONIC OBSTRUCTIVE LUNG DISEASE

Obstructive lung disease is an absolute contraindication to diving. These patients have a combination of things like airway obstruction, and emphysema with blebs through the lungs. They have very unstable lungs. They are also prone to pneumothoraces, so should not be allowed to dive. Most of them are so sick that they rarely want to do anything like diving anyway. There are some people with

early chronic obstructive lung disease with bronchitis and emphysema who might want to get into diving. If one is convinced that the patient has some degree of chronic lung disease, then the studies that are needed, the chest X-ray and the pulmonary function studies, are going to be done to prove to that individual that he should not be diving.

Studies should be done to demonstrate things that one expects to be there rather than as a blind screen to try and pick up things which are unexpected. That attitude will cut studies down to those that are going to be most useful.

## CHEST SURGERY

I have seen any number of people after all kinds of chest surgery who are diving. They were divers before they had the operation and they are still divers. They do not seem to have any major problems. Sometimes I see people long after the operation, or I go diving, see the big scar on their chest, and find out that they had some kind of chest surgery. It is well 'after the fact' when they say "Do you think it is alright to dive?" "I had an operation 22 years ago and I have been diving for 20 years".

I am not too concerned about people who have had chest surgery. Obviously, if somebody has a massive deformity of the chest from surgery, then one might have to worry. I think a thoracotomy for a subsegmental resection of a lung, or some kind of cardiac surgery, or a patent ductus ligated of an ASD repaired 15 or 20 years before, is not going to cause trouble with diving. Chest surgery per se is not an absolute contraindication. One has to look at what was done and what was resected or repaired before one can make a decision.

## PULMONARY PHYSIOLOGY

The normal response to exercise is an increase in ventilation with a slight drop in  $PCO_2$ , a stable arterial oxygen content, and a tiny rise in alveolar oxygen, which takes the place of the  $CO_2$  that has gone down. Somebody mentioned  $CO_2$  retention with exercise. That is not usually the case but if one is breathing through a snorkel, a long airway, or a regulator, where one has an extra piece of breathing apparatus that can limit ventilation, there will not be this normal response with exercise. If there is some restriction in the airway then there will be  $CO_2$  retention. That does happen if one has a regulator that resists inspiration. I had one and I never realised it was bad. It was an old double hose, single phase regulator. The tank valve was getting gunked up and over several months the regulator became a little harder to breathe with each dive. I was getting dyspnoea when I dived and I did not quite understand what the problem was. I worked out that I had to draw so hard on the regulator that I was using an extra amount of energy for my respiratory muscles and yet limiting ventilation, so that  $CO_2$  was building up. This can happen, but it is not a normal physiological response. That is just poor care of equipment.

If we look at chronic obstructive lung disease in the same context the first thing we notice is that these people can not ventilate as much as normals. They can not reach levels of exercise that the normal person gets to. They are limited by inadequate ventilation. Tidal volume does not go up much. One of the problems with the chronic obstructive lung disease patients is that they lose their capacity to expand their lungs. Their lungs are chronically expanded with high dead spaces. Arterial  $CO_2$  goes up and arterial oxygen comes down. It starts low and does not change very much with the small amount of exercise that they are capable of. It will in fact go if one can get these patients to exercise enough. These patients retain  $CO_2$  and get severely dyspnoeic with small amounts of exercise.

There is another reason besides the mechanical aspects of the possibility of the rupture of a bleb or embolism because of airway occlusion, why these patients should not dive. They would have a terrible time with the exercise needed to do the normal things you have to do for diving, as they will retain  $CO_2$  and get severely dyspnoeic.

Another kind of lung disease that can be a problem is the diffusion abnormality. In the United States the most common diffusion abnormality in a young person who might want to dive is sarcoidosis. It is not a common disease, but on the other hand it occurs in the population of young people who might want to take up diving. They get interstitial infiltrate in the lungs, which causes diffusion changes. Their ventilation is not affected because the airways and alveoli are normal. The tidal volume may be reduced by some stiffening of the lungs. Remember with diffusion abnormalities it is oxygen that is a problem.  $CO_2$  diffusion is usually unaffected, so  $CO_2$  will go down as there is excess ventilation. The arterial oxygen content will be low at rest, so these patients get hypoxic when they exercise because they do not get enough oxygen into the bloodstream. A patient with a diffuse interstitial process in the lung, who seems to have a normal airway function is still going to have trouble, at least with the exercise aspect of diving. They can run into problems with acute oxygen deficits. It is unreasonable to argue that since one can provide oxygen at higher partial pressures, diving ought to be the sport for these people. I do not think that argument is valid. We should not put these people in the water in the hope that the higher  $PO_2$  that they inspire underwater will help their diffusion of oxygen. They will probably still be limited. It is not worth taking anyone with an interstitial process in the lung diving, even if their mechanical function looks good. They are going to have trouble in the water.

## INVESTIGATIONS

One of the advantages of a chest X-ray is that sometimes it shows something that is unexpected. One such thing was a cancer in the right upper lobe. I suppose that the one argument for screening chest X-rays is to find things that one does not expect. One would not expect to get much out of screening chest X-rays in the average population. For

diving candidates over the age of forty or fifty, a routine chest X-ray may be worth while. But for the younger population, late teenager and young adult, it is not reasonable to do a screening chest X-ray.

It used to be that there was a fairly high incidence in the United States of tuberculosis infection. Not the disease per se, but a healed infection. Until the 1960s it was said that one third of the population had evidence on the chest X-ray of old tubercular infection, a Ghon complex with a nodule. So screening chest X-rays were considered useful to pick those people up. But the incidence of a TB infection in the population is low now, probably ten percent or less, that is, asymptomatic infection leading to chest X-ray changes. So even screening for TB with a chest X-ray is being dropped. If there is any concern, people are now using tuberculin tests for screening rather than using a chest X-ray.

Screening chest X-rays are to pick up some underlying process in the lung. One may want to do them in the older population, because they are more likely to have something like a nodule show up in the chest X-ray.

One of the ways that one can find out the extent of a bulla is to do a lung scan. Unfortunately the sensitivity of a scan is even worse than the X-ray to pick up small pleural blebs. So neither is going to be very useful.

A problem that comes up once in a while is old tuberculosis. Active TB with a cavity is obviously a contraindication to diving. Is somebody who had had an old infection leaving a little scarring of the apex, especially a large number of adults who have tiny flecks of scar at the apices, going to have a problem with diving? I do not think so. These people do not usually have problems with their chest function and a small amount of reticulated density at the apex should not really be a reason to keep these people out of diving.

## CONCLUSIONS

I think that when there are gross abnormalities of the lung one should not allow diving. That would include anything that looked like a cancer or tuberculous gland because they cause some airway obstruction. Obvious pulmonary disease is not a problem.

The problem with spontaneous pneumothorax is going to be around for a long time and the way to detect those sub-pleural blebs is always going to be a problem.

The ex-asthmatic who is asymptomatic and who has not taken drugs for years is going to be a problem because they seem to show up every now and again, for no good reason, with an asthma attack that would have been unpredictable based on their past experience. I guess we are stuck with not knowing when these people will get an asthma attack associated with diving. Other than that I think one has to

make individual judgements. I would opt for studies when one thinks a study is going to prove an abnormality present, rather than the other way around. I am against using studies to prove normalcy, because what one is doing there is trying to prove the absence of disease. Usually one can do that by careful evaluation of the history and the physiological examination. If somebody has no history of asthma then I do not think one has to prove that person does not have asthma. On the other hand, if somebody says he had asthma, one would like to prove that he had airway obstruction, then a pulmonary function test would be useful and likewise a chest X-ray. If there is something in the patient's history or physical examination that could be verified by chest X-ray, then I think one ought to get a chest X-ray. I do not recommend a chest on everybody with the idea that one might find something that proves normalcy. It is just a big screening effort that is relatively unproductive.

Question:

What about diving after chest wall injury?

Dr Fred Bove

Generally, I would say yes to that. I have known at least three people who have had some traumatic problem with the lung. A commercial diver had an empyema which needed a partial rib resection with a big drain. That all healed up. He now has an area of pleural thickening at the left base. He dives without any problems. I think such a lesion would not produce any bleb on the lung. If anything, the result is to produce adhesions in the pleural space which would prevent a total lung collapse. After a stab wound, or some other traumatic injury, when the lung has reinflated, the chest dynamics are normal and if there is no severe anatomic derangement inside the chest, then that person could probably dive.

Dr Bruce Bassett

In the USAF some flyers who have had a spontaneous pneumothorax have returned to flying after surgery to strip the pleura.

Dr Fred Bove

Thoracic surgeons are really hot on that. They feel that if they strip away the entire pleura then there ought not be any problems in the thorax. Say a patient had four recurrent spontaneous pneumothoraces on the left side, so the surgeon goes in and strips away the left pleura. What about the right pleura? Remember that the lesions are usually bilateral. Should one clear him to dive, if he has not had his right pleura stripped? I suppose that if a commercial diver had a spontaneous pneumothorax and wanted to get back to diving, he could argue that stripping the pleura would make him eligible for diving. I think he would have a hard time arguing with the company, but the Air Force and the rest of the military are flexible and may let you do that.

Question:

What about cigarette smoking and diving?

Dr Fred Bove

When somebody comes into me who smokes, I rip the cigarettes out of their pockets, throw them in the trash can and stomp on them a couple of times. That is just an attitude that I have. I think the more violent you are against cigarettes, the more your patient thinks you mean it. Cigarette smoking can cause bronchospasm. Invariably with a heavy smoker one can hear their lungs wheezing. There are often little scattered areas of atelectasis that cause a few rales and crackles and snorts in the lungs. A chronic heavy cigarette smoker has terrible sounding lungs. If I hear wheezing, I say "I am sorry, you just cannot dive. Come back in 3 months after you have stopped smoking and we will see what you are like then." If a heavy smoker is demonstrating problems with airways on physical exertion then I would not clear him. That is another situation where chest X-ray will not tell you very much. Small changes in the airways just will not show up on a chest X-ray. A smoker with enough changes in his lungs to show up on a chest X-ray is a symptomatic chronic lung patient.

Dr Ian Unsworth

You say that you are not very concerned with pleural adhesions and pleural thickening because there might be less likelihood of a pneumothorax. I got the impression that you were very concerned about the onset of pneumothorax underwater. I wonder whether a very stiff lung, or a lung that has areas of thickened pleura and areas of normal lung parenchyma, might not in fact be more prone to something far worse than pneumothorax, in other words, an air embolism. It seems to me where the pleura is adherent to the chest wall in certain spots, then if that lung was put to any overpressure then the pleura is not going to slide properly and therefore the risk of lung tearing and air embolism is increased. Could you please comment on that? I am not concerned about pneumothorax underwater, but I am concerned about differential stretch in the lung tissue and therefore small tears.

Dr Fred Bove

I am not aware of adhesions to the lung causing a problem like that. It is theoretically possible, but the experience I have had with those kinds of problems are relatively limited, about ten people. I do not have an answer. It is a good theoretical consideration.

Dr John Knight

Professor Colebatch, in Sydney, studied a number of people who had burst their lungs and his paper suggested that they had areas of extra stiffness in their lungs which explained why they got their pulmonary barotrauma better

than anything else. But he has only published one paper on about eight or nine divers.

*Dr Carl Edmonds, who referred these RAN and other divers to Professor Colebatch, elaborated on the concept of regional variation in lung compliance being responsible for pulmonary barotrauma. Unfortunately the recording was too faint to allow transcription.*

Dr Janene Mannerheim

Some people occasionally wheeze when they have hay fever. I have had long arguments with these people about their suitability for diving. Should one test them before and after bronchodilators and exercise? Would you say that they can dive when they do not have hay fever?

Dr Fred Bove

One gets into enormous battles with these people. They only wheeze during the worst hay fever season. When the season is over, they do not wheeze any more. One decides they can not dive. One does pulmonary function tests because one is convinced that they are going to have abnormalities. Do the tests in the fall, instead of the spring, and they have perfectly normal pulmonary function under all circumstances. Now what should one do? I do not know. I suppose that one could say that in the fall when there is no hay fever, diving is alright. It seems to me that one has to test them every year, to prove they are normal in the fall, then let them dive for three months, and stop when the hay fever starts in spring.

A lot of these people ultimately develop asthma. They have recurrent hay fever, then all of a sudden they have asthma along with it. I do not like to have these people in the water because they get a little allergic stimulus when they are off on a trip somewhere and then they start diving with some bronchospasm. Maybe the answer to that is to tell them "I will clear you for one year and you have to come back for pulmonary function tests very year". That is going to chase half of them away, because pulmonary function tests are expensive.

Dr Janene Mannerheim

We have been doing both expiratory and inspiratory X-rays. We have picked up sarcoidosis and hyperinflation and medium sized bullae and TB in Argentinians, Greeks and Indo-Chinese. I feel that it is worthwhile continuing to do X-rays, even if there is only one positive in two hundred.

Dr Fred Bove

I guess it is the population. If one is picking up significant pathology in a certain population, you have to be flexible.

The population I was talking about is the teenager or the young adult, who has been in the local community all his life. I do not think one is going to find one in two hundred in that population. It is more likely to be one in five or six hundred. In the transient population, if you know they come from an area where some kind of pulmonary problem is endemic, then I think it is worth while.

Dr Janine Mannerheim

If someone has fragments of bullets throughout his lungs, with scarring around them, what would you say to that?

Dr Fred Bove

I would say that they would probably have some airway obstruction somewhere. It does not take much to cause pulmonary barotrauma. The US Navy experience in submarine escape is that they can not predict who is going to get an air embolism. All the submariners had pulmonary function tests and inspiratory chest X-rays. Anybody who had an abnormality was taken out of the programme. Everyone who was doing submarine escape had passed all their screening tests. They trained them thoroughly so that they were exhaling during ascent yet they could not predict who was going to get an air embolism after this thorough screening. What they said was that there was probably some local, small airway that was obstructed enough to put some air into the arterial system and cause a cerebral lesion. It can be a very small obstructed airway or segment of the lung that you cannot pick up.

In submarine escape training they still do all these screening tests, but they still expect a small incidence of air embolism in spite of these tests and the fact that all the trainees are going to do their rapid ascent in a perfectly normal way.

Dr Janene Mannerheim

If a person has a history of sarcoidosis and they have been on steroids and finally they have a normal chest X-ray, can they dive then or will they have areas of scarring that one cannot see?

Dr Fred Bove

The first thing to do is thorough pulmonary function studies to make sure that they have no sort of obstruction. After that, I do not know what to say. The chronic sarcoid patient usually does have some damage to the lung interstitium with some airway obstruction. It can be detectable or it can be below the level of detection by normal pulmonary function studies. So it is a hard question. With somebody who had significant sarcoid lung disease and required steroids, I would probably not let them dive. Because although they have a normal looking chest X-ray, they still end up with permanent parenchymal damage to the lungs, some scarring here and there and probably somewhere some airway is going to be obstructed. It only takes one little obstructed airway to cause trouble.

Dr Mike Page

In doing diving medicals there seems to be a small proportion of people who have no history of asthma, nor history of allergy, who on physical examination on forced expiration had a wheeze, usually in the right upper zone. They have normal pulmonary function tests and normal expiratory chest X-rays. Is there any reason for this or is it just my ears?

Dr Fred Bove

You are right. Everybody has a type of wheeze in the right upper zone. It is one of the major right upper lobe airways, which is near the chest wall and it is easy to hear. It is not really a classic, high pitched wheeze. In is a little lower pitched. We also have to be careful about calling normal findings "abnormal". It is a fairly characteristic finding with rapid expiration in the right upper lobe.

Question:

Why will the submarine service not take people with abnormalities on their chest X-rays?

Dr Fred Bove

The crew will be underwater for three months or more and because of their operations they do not want to come to the surface. So they are very careful about the health of the submariners. Part of the screening process for submarine escape fits into this. They do not want anybody who is going to have the risk of anything happening to him in the submarine service. They figure that if they put men with abnormal chest X-rays on board, they may lose them if they ever had to do a submarine escape. Submariners, enlisted sailors and officers, are all very carefully screened medically and psychologically.

Question:

People who have fairly low FEV<sub>1</sub>/VC ratios, have lungs that are more at risk than normal. Why not recommend a slower ascent rate?

Dr Fred Bove

I guess it is the same old thing. In sport diving if you say that a person is fit for diving and he gets a certificate, there is not organisation in the United States that puts a limit on the card. All it says is "Certified Diver" not "Certified Diver who must ascend at no faster than 25 feet per minute". It does not say "Certified Diver, but not to dive deeper than 33 feet". There are no limitations put on it. As far as I am concerned, it is unwise to assume that a person is going to always remember, including under stress, to ascend at a slow rate because he has problems with his lungs. I would much rather just not let him dive.