

Chapter 38

MEDICAL EXAMINATIONS FOR DIVERS

This chapter is not adequate to instruct a medical practitioner on the complexities of performing diving medical examinations. Special courses and qualifications are needed for this purpose.

Because of the unique physical and physiological conditions encountered in diving, medical standards for divers differ considerably from those of other sports. As a result it is sometimes necessary for a diving physician to advise a prospective diver against diving because of a disqualifying condition. Sometimes the recipient of this advice is supremely physically fit, and some have been of Olympic standard. These individuals understandably find it difficult to comprehend how a physically fit athlete is not necessarily fit to dive, medically.

To those with more knowledge of diving patho-physiology it becomes obvious that even the highest standard of physical fitness will not protect a diver from some of the complications from lung cysts or asthma, from a diving death.

The examining physician must consider many factors when conducting a diving medical examination. Almost 10% fail the medical and 10–15% incur specific diving limitations or advice, for safety reasons.

PSYCHOLOGY

The ideal diver is probably the cool James Bond like character we would all like to be - stable, calm under stress, able to endure physical and mental pressure, not prone to anxiety, able to conveniently ignore danger, slightly overweight and perhaps not surprisingly, a fluent liar.

Psychological stability is difficult to evaluate during the medical examination. Some clues may be gained from the history of sporting activities and occupation. Often the diving instructor is best able to evaluate the diver's psychological make-up during the course of instruction.

AGE



Ideally the trainee diver should be aged between 18 and 35 years although exceptions can be made at both extremes of age. Divers over 45, if complying with the medical standards should be acceptable, but may require special tests such as a cardiac risk assessment and physical fitness checks.

Divers younger than 16 require very careful supervision during and after training because of their often smaller stature, limited strength and (most importantly) emotional immaturity. A buddy line to an experienced adult diver is recommended during the training of youthful divers. The mature and experienced buddy of an adolescent diver should take control of the dive and remember that his buddy may be an unreliable rescuer if difficulties arise. Most reputable medical authorities will not certify divers under the age of 15–16 years, without imposing serious limitations. This does not prevent younger divers being given a limited "diving experience" by qualified diving instructors under very strict and controlled conditions, and provided they are medically fit.

Fig. 38.1

OCCUPATION

Pilots and aircrew are advised of the risks associated with flying after diving. Musicians, sonar operators, cardiologists, pilots and others reliant on excellent hearing for their livelihood are informed of the small but real risk to their hearing, or development of tinnitus, should they suffer ear barotrauma.

MEDICATION

Any illness requiring drug treatment needs careful consideration because either the illness or the drug may compromise diving safety. Sedatives, tranquillisers, antidepressants, antihistamines, anti-diabetic drugs, steroids, anti-hypertensives, anti-epilepsy drugs, alcohol and hallucinatory drugs such as marijuana and LSD all place the diver at risk. See Chapter 37 for more specific details.

Some antibiotics may have no direct adverse effect on diving, but the condition for which they were prescribed may have.

Experience and experiments indicate that many drugs which affect the brain have unpredictable effects on a diver exposed to the very high pressures encountered in deep diving.

HEART

Most heart diseases or abnormalities of heart rhythm are incompatible with safe diving and are disqualifying conditions. They can often be inferred from the personal or family history, clinical examination, biochemical tests or electrocardiograms (ECGs). The blood pressure should be normal for the age of the diver. See Chapter 35.

OBESITY

The overweight person is more prone to decompression sickness when air diving and is likely to have a reduced level of physical fitness. Most physically fit obese individuals may dive safely with appropriate reductions of the allowable durations of dives.

LUNGS

Lung disease is a disqualifying condition. The diver needs normal lung function to allow a reserve of respiratory function to cope with exertion and to permit easy air flow from the lungs to avoid pulmonary barotrauma. The lungs must be very elastic to enable them to stretch during sudden volume changes on ascent. A history of asthma, chronic bronchitis, bronchiectasis, fibrosis, cysts, spontaneous pneumothorax, chest injury or chest surgery are disqualifying conditions.

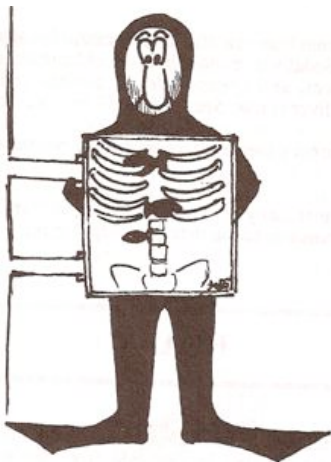


Fig 38.2

The doctor may be able to detect localised airway obstruction (which can lead to a burst lung) by listening to sounds made in the chest when the diver breathes deeply and rapidly. The history and **respiratory function tests** (expiratory spirometry) aid in the assessment. Occasionally radiological screening (Chest X-ray, CT scan etc.) may be necessary.

There was a dramatic drop in the incidence of burst lung in Australian Navy divers after the institution of these standards.



Fig. 38.3

Diving candidate blowing into a "Spirometer" to assess lung function. These devices have been largely replaced by digital expiratory spirometers, standardised for the specific population being tested.

EAR, NOSE AND THROAT

The ears, nose, throat and sinuses account for most diving induced illnesses. Any acute infection such as a cold will temporarily disqualify a candidate. A history of chronic or recurrent allergies, hay fever, sinusitis, tonsillitis, or tooth decay needs special assessment. Diving should be avoided while so affected. A deviated nasal septum (often appearing as a crooked nose) can cause obstruction of the sinus openings. All these factors can predispose to **sinus** or **ear barotrauma**.

The ears are carefully examined. The outer ear must be free from infection and not blocked with wax. The eardrum must be seen to be moved voluntarily during the **Valsalva**, or other equalising manoeuvre. An eardrum which has been scarred from previous perforation may be weakened. The examining physician, by viewing the ear drum while the diver attempts middle ear equalisation, can advise on correct techniques to be used when diving.

The hearing function test (**pure tone audiogram**) measuring hearing up to 8000 Hz is performed. Any significant hearing loss is regarded seriously since there is a risk of further hearing loss if **barotrauma** to the ears occurs during the diver's exposures.

Damage to the hearing organ may also be associated with disturbance of the balance organ. A special type of balance test is used to detect this, called the Sharpened Romberg, and further investigation is by an electronic measurement (electronystagmogram) if necessary. It is important to detect any balance organ dysfunction since it can lead to **vertigo** and **vomiting** underwater.

EYES

Good **vision** is essential for the diver to see his boat or buddy, if he surfaces some distance away. A diver who has impaired vision can have **corrective lenses** included into his face mask, but should always dive with a visually fit buddy in case the mask is lost or broken during the dive. See Chapter 5.

Contact lenses can pose problems and advice is needed about these. Hard lenses can trap bubbles between them and the cornea, causing pressure damage. Soft lenses are susceptible to loss – especially during mask removal. These divers are advised to keep the eyes closed when removing the mask, either underwater or on the surface. See Chapter 32.

The operation of **radial keratotomy**, used to surgically correct short sightedness, can cause problems. With this procedure, the cornea is cut radially in a sunburst pattern to change the curvature of the cornea. These cuts weaken the cornea which is prone to burst if the eye is bumped or subjected to external pressure reduction. If such a diver develops face mask squeeze (see Chapter 12), the eyeballs may actually rupture. Anyone who has undergone this operation should not dive. Most modern techniques, such as Laser resections for myopia, involve only minimal damage to the cornea, and are not a problem.

Colour vision is of lesser importance, apart from a few professional diving situations involving colour coded cylinders or wires (involving explosives).

BRAIN

Any disorder of the nervous system will complicate and confuse diagnosis and treatment of diving illnesses such as cerebral air embolism and decompression sickness.

Epileptics, even if controlled by drugs, should not dive as an epileptic fit underwater could prove fatal. The higher partial pressures of oxygen encountered during a scuba dive may render these persons more vulnerable to such attacks. Hypoxia, hyperventilation and sensory deprivation can aggravate fits. Many divers have had their first fit underwater.

Migraine is often made worse by diving (see Chapter 32). Severe migraine attacks leading to incapacity have occurred during dives in previously mild sufferers. It may also complicate recompression treatments. If certain precautions are observed some migraine sufferers can

engage in limited diving in reasonable safety. A patent foramen ovale in some divers may increase the frequency of migraine.

GENERAL CONDITIONS

Other diseases of the body such as **diabetes mellitus** (see Case History 33.6), severe **kidney** or **liver** disease also increase the risks of diving.

Muscle, bone and **joint** diseases or injuries can predispose to decompression sickness and make diagnosis and treatment of this disorder more difficult. Fatigue may be induced more easily.

Professional divers or those who frequently undertake decompression diving may require **long bone radiology or scanning** (see Chapter 17) to establish a baseline in the event of bone abnormalities developing, and for legal reasons. Because of the low risk of dysbaric osteonecrosis, the cost and the potential hazards posed by radiation exposure, these are not usually recommended for recreational divers.

A history of **motion sickness** is significant because it interferes with safe diving and it is difficult to vomit through a demand valve. Divers with a propensity to this condition need advice from the physician on remedies for seasickness which are compatible with safe diving (see Chapter 32).

Smoking diminishes physical fitness and can predispose to lung, sinus and ear barotrauma.

Pregnancy should preclude diving (see Chapter 8).

PHYSICAL FITNESS

This refers to the strength and speed, so necessary to athletes. It includes muscular, cardiac and respiratory capabilities. It is important to divers, as they are often called upon to exert themselves, to survive. One reasonable standard is to require an ability to swim, unaided, a distance of 200 metres in less than 5 minutes for recreational divers who do not subject themselves to difficult conditions. For professional or competent divers, this could be reduced to 4 minutes.

Medical fitness for diving refers to the freedom from illness likely to prejudice diving safety. **'Physical fitness' does not necessarily equate with 'diving medical fitness'.**

It is not uncommon for physically fit young individuals to feel quite distressed when advised against scuba use by diving medical practitioners.

MEDICAL EXAMINATION FORMAT

There is little doubt amongst responsible diving instruction groups and diving medical associations, that mandatory full and comprehensive medical examinations should be performed on all divers before commencing scuba training. It is also needed before using scuba apparatus – even in such shallow and apparently safe locations as a swimming pool.

During a recent workshop on diving medical examinations, the following consensus was achieved with this advice for recreational divers:

- All diving candidates must be examined according to an established diving medical Standard. An example is the South Pacific Underwater Medicine Society (SPUMS) Medical Format (included in this Chapter) prior to commencing any use of scuba apparatus – even if only in a pool.



Fig 38.4

- The medical examiner must have been trained appropriately (at a recognised course) in diving medicine.
- Should any doubt exist as to the 'fitness' of an individual, then that person must be referred to a specialist diving medical practitioner (i.e. one with extensive training and experience in diving medicine).

This textbook is not aimed at instructing medical practitioners in Diving Medicine – although it will serve as a useful primer for those interested in this type of medicine. A list of recommended courses of instruction and reading texts is included in Appendix A.

A copy of a typical **Diving Medical Format** follows. It is suitable for candidates wishing to experience Scuba diving or to subject themselves for diver training. It must be performed and interpreted by a physician trained in diving medicine by an accredited body.

It comprises 3 sections:

- (1) **Medical history**
- (2) **Diving [and diving medical] history**
- (3) **Clinical examination and investigations.**

Each is necessary and every item except for identification data, is of relevance to diver safety and diving limitations.

APPENDIX B
PRE-DIVE MEDICAL FORM FOR PROSPECTIVE ENTRY-LEVEL SCUBA DIVERS
The first two pages to be completed by candidate.

1	Surname	Other Names	2	Date of Birth
			4	Sex: Male Female
3	Address		5	Telephone (Home)
6	Principal Occupation		7	Telephone (Work)
8	Intended Dive School			
9	Do you participate in any regular physical activity?		Yes	No
10	Description of activity			
11	Do you smoke?		Yes	No
12	Do you drink alcohol?		Yes	No
13	How many drinks a week?			
14	Are you taking any tablets, medicines or drugs?		Yes	No
	List:			
15	Do you have any allergies?		Yes	No
	Details:			
16	Have you had any reactions to drugs or medicines or foods?		Yes	No
	Details:			

Have you ever had or do you now have any of the following? Tick Yes or No.

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Notes on History

	Yes	No
54	Chronic or persistent cough	
55	TB	
56	Pneumothorax ("collapsed lung")	
57	Frequent chest colds	
58	Asthma or wheezing	
59	Use a puffer	
60	Other chest complaint	
61	Operation on chest, lungs, or heart	
62	Indigestion, peptic ulcer or acid reflux	
63	Vomiting blood or passing red or black motions	
64	Recurrent vomiting or diarrhoea	
65	Jaundice, hepatitis or liver disease	
66	Malaria or other tropical disease	
67	Severe loss of weight	
68	Hernia or rupture	
69	Major joint or back injury	
70	Limitation of movement	
71	Fractures (broken bones)	
72	Paralysis or muscle weakness	
73	Kidney or bladder disease (cystitis)	
74	In a high risk group for HIV or AIDS	
75	Syphilis	
76	Diabetes	
77	Blood disease or bleeding problem	
78	Skin disease	
79	Contagious disease	
80	Operations	
81	In hospital for any reason	
82	Life insurance rejected	
83	A job or licence refused on medical grounds	
84	Unable to work for medical reasons	
85	An invalid pension	
86	Other illness or injury or any other medical conditions	
Have any blood relations had		
87	Heart disease	
88	Asthma or chest disease	
89	TB	
Females Only		
90	Are you now pregnant or planning to be?	
91	Do you have any incapacity during periods?	

92 Date of most recent chest x-ray

Previous Diving Experience		Yes	No
93	Can you swim?		
94	Have you ever had any problem during or after swimming or diving?		
95	Have you ever had to be rescued?		
96	Do you snorkel dive regularly?		
97	Have you tried scuba diving before?		
98	Have you had previous formal scuba training?		
99	Year		
100	Approximate number of dives		
101	Maximum depth of any dive		
102	Longest duration of any dive		

I certify that the above information is true and complete to the best of my knowledge and I hereby authorise Dr. _____ to give medical opinion as to my fitness, or temporary or permanent unfitness to dive to _____ (Diveshop). I also authorise him or her to obtain or supply medical information regarding me to other doctors as may be necessary.

Signed: _____

Date: _____

