

# DOCTOR AT SEA

## Oxygen – not too much, not too little, just right

There are not many workplaces that have a ready supply of oxygen but most yachts do and that can be so much help when someone has a breathing problem.

Emergency breathing problems can arise from near-drowning incidents or diving accidents or from ostensibly low-key situations like choking on food. Any of these can lead to cardiac arrest, and death, if intervention is unsuccessful or delayed. Resuscitation from this type of low oxygen crisis can be successful and, if the victim starts to breathe on their own, high-flow oxygen is indicated at levels over 90% for a few minutes till recovery is established.

The normal atmospheric oxygen level is 20% (plus 79% nitrogen and 1% a mixture of inert gases like argon) and exhaled breath is 16% oxygen because some is absorbed and used by the body. This oxygen is converted to carbon dioxide as a waste product and makes up 4% of exhaled breath. The levels of oxygen and carbon dioxide in the blood are controlled by respiratory drivers which are working non-stop without any conscious thought on our part. The carbon dioxide driver stimulates breathing when the carbon dioxide level in the blood is high and we blow off the excess – conversely, the oxygen driver clicks in when the oxygen level drops and needs to be replenished.

These drivers normally work smoothly and automatically most of the time but we can over-ride them as, for instance, in breath holding underwater or playing a wind instrument or in over-breathing with severe anxiety. Some free divers deliberately over-breathe to extend their dive but this is very dangerous because the carbon dioxide driver is rendered temporarily out of action and the oxygen driver does not kick in soon enough as the oxygen level starts to drop – the victim quietly stops breathing underwater without any struggle or cry for help, so called “shallow water blackout”. Something similar happens in deep water blackout affecting deep water free divers (but is complicated by the additional effect of the drop in oxygen pressure and also the potential physical expansion of the lungs during ascent from the dive). In short, over-breathing and diving don't mix safely.

Anyone subject to chronic chest infections from lung damage due to, for example, long-term smoking or industrial dust exposure, will not have the nicely balanced tandem of respiratory drivers. Their damaged lungs do not release carbon dioxide as efficiently and they retain high levels all the time so that the carbon dioxide driver becomes stunted and inefficient. Their low oxygen driver becomes more sensitive and, to some extent, compensates for the deficiency but it is counter-productive ever to treat them with high level oxygen because this will inhibit their oxygen driver when there is no carbon dioxide driver available to pick up the responsibility to breathe – they are blissfully happy on high level oxygen for a few minutes until they lose the drive to breathe! It is far better to compromise with only 24-28% oxygen in these cases.

However, breathing difficulties associated with, for example, asthma or a heart attack do well with 50-60% oxygen because their respiratory drivers are working normally.

The use of higher level oxygen, more than 90% as in diving or choking accidents, is not necessary and also the treatment may be required for a much longer time than in those accidents and the supplies would run out very quickly at high level usage.

Oxygen supplies at sea normally come compressed in cylinders fitted with regulators and flow meters to adjust the enrichment level and they connect to the patient by plastic tubing and an oxygen mask. The pulse oximeter is a small but useful piece of kit which is now in widespread use. It is battery-powered and clips onto the end of a finger to give a reading, within a few seconds, of the blood oxygen level and this has obvious benefits in making the initial assessment of a patient and also in monitoring their response to treatment.

Oxygen onboard is a huge asset in the workplace and the next step is to know when and how to use it. MCA courses on Medical First Aid and Medical Care Onboard Ship cover these areas in some detail and can help to *breathe life* into a distressed person! Details of our courses are provided below.

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