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A NEW SYSTEM OF GIVING OXYGEN TO DIVERS IN AN EMERGENCY

Ken Wishaw

I would like to describe a simple alternative method of delivering high concentration oxygen to awake patients with decompression sickness. I believe it is an improvement on systems at present in use, and does not appear to have been described before.

With the increasing emphasis on the value of normobaric oxygen therapy as soon as possible after the onset of decompression sickness, this method should be of interest to members of SPUMS and to divers generally.

The following are the desirable features of such a system:

It should:

1) Supply a high concentration of oxygen,

2) Be economical in oxygen usage as oxygen supplies on boats or during transfer may be limited,

3) Comfortable to use,

4) Easy to assemble and fit to patient,

5) Cheap,

6) Not susceptible to corrosion,

7) Easy to clean,

8) Compact,

9) Able to be used for ventilation of non-breathing patient with oxygen and still be able to ventilate if the oxygen supply is exhausted.

The use of the Mapleson C style resuscitation bag attached to an anaesthetic mask and held in place by a Clausen harness has been popular.

However its disadvantages are:

1) Effective sealing of the mask on the face is difficult, leading to air entrainment,

2) It is uncomfortable,

3) Oxygen requirements are high if rebreathing is to be prevented,

4) It cannot be used for mechanical ventilation if oxygen supplies are exhausted.

More recently there has been marketed an adaptor (Bendeez) which allows scuba regulator to be attached to oxygen cylinders.

This has the advantage of using a familiar and comfortable delivery system, namely the rubber scuba mouthpiece. A noseclip, or a first aider's fingers pinching the nose or wearing a diving mask, is required to prevent breathing through the nose diluting the oxygen with air. The Bendeez system delivers 100% oxygen and is economical with the use of oxygen.

The disadvantages of this system are its inability to be used as a ventilator and the potential hazard of fire if incorrect lubricants have been used in the regulator.

For completeness, portable recompression chambers should be mentioned but they are beyond the scope or pocket of most divers.

The system I have devised meets all of the above desirable features.

A resuscitation bag is used, but instead of an anaesthetic mask and harness, a standard rubber scuba mouthpiece is fitted. Most brands of scuba mouthpiece fit the 22 mm male taper of resuscitation valves. This simple conversion eliminates all the disadvantages described above. A nose clip is required or the patient can wear his diving mask to seal the nose or a first aider can pinch the nose shut.

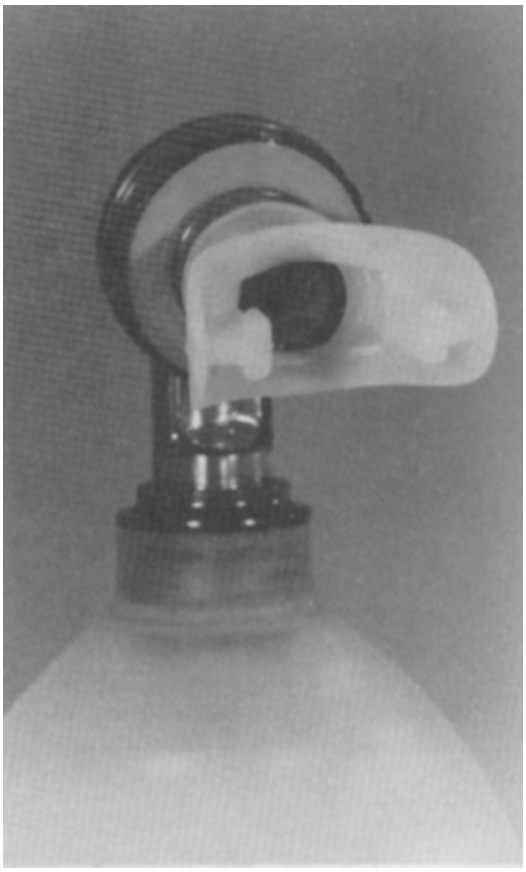

Figure 1 Laerdal bag with Scuba mouthpiece fitted to non-rebreathing bag in place of a face mask.

Figure 2 Laerdal bag system in use showing, from the bottom, collapsible oxygen reservoir bag, air entrainment valve, self-inflating bag, non-rebreathing valve and nose clip.

The second alteration is to replace the Mapleson C type bag with a Laerdal brand resuscitation bag.

The Laerdal bag consists of a Laerdal non-rebreathing valve and a self-inflating bag with an air entrainment valve and a collapsible oxygen reservoir bag. This brand of resuscitation bag is probably the most popular brand in New South Wales and is the standard bag used by the NSW Ambulance Service.

The advantage of this particular brand is the valve itself, which is of low resistance, non-corrosive and can be used both for mechanical ventilation (resuscitation) and spontaneous respiration. Most similar valves available will not allow spontaneous respiration. Being a self-inflating bag, the system may be used for ventilation and will continue to do so if the oxygen supply is exhausted.

Gas analyses of the Mapleson C and Laerdal bag systems were performed using a mechanical lung and chest model to simulate a 70 kg patient. With a tidal volume of 700 ml and respiratory rate of 10 breaths per minute. Various fresh gas flows were used.

When the fresh gas flow was equal to the inspired minute volume, namely 7 litres per minute, the inspired oxygen concentration was over 97% in both cases. However it must be remembered that the Mapleson C system is a rebreathing system and "acceptable" levels of rebreathing require a fresh gas flow of at least twice the minute volume. The Laerdal system is more economical of oxygen. The fresh gas requirement for the Laerdal system can be judged clinically by ensuring the reservoir bag is fully inflated at end expiration. (Significant air entrainment only occurred at fresh gas flows of less than minute ventilation. Taping over the air entrainment valve is thus not necessary).

The Laerdel resuscitation equipment (with whom I have no affiliation!) is readily available through the medical supply company, Drager and can be purchased in a compact, durable, plastic box complete with Guedal airways and masks but without a nose clip or scuba mouthpiece for just over $200. (Laerdal Silicone Resuscitation in Compact Case, catalogue number 87 00 03). To give oxygen an oxygen regulator (reducing valve) and a flow meter will be needed.

This combination of Laerdal bag, scuba mouthpiece and nose clip represents a simple and significant improvement for oxygen delivery to the awake patient.

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FUTURE MEETINGS

IX INTERNATIONAL CONGRESS OF HYPERBARIC MEDICINE
Hilton Hotel, Sydney, 1-4 March 1987

UNDERSEA AND HYPERBARIC MEDICAL SOCIETY

Hyatt Regency Hotel, Baltimore, 27 - 30 May 1987

NITROGEN NARCOSIS AND THE CAVE DIVER

Peter Horne

The increasingly popular pastime of recreational scuba diving is today becoming better understood by both the diving community and the general population. However, there are three aspects of the underwater world which still tend to dominate the headlines and affect the "average Joe's" perception of our activity, SHARKS (giant man-eating fish a la Jaws); THE BENDS (an agonising and usually fatal disease which afflicts all divers who surface too quickly, according to midday TV soap operas); and RAPTURES OF THE DEEP, a form of drunkeness caused by diving "too deep", invariably resulting in drowning when divers hand their scuba gear to passing fish!

Fortunately, those of us who actually dive are very well educated in recognising such hazards and know how to deal with them ... DON'T WE?! We all know that you carry a big knife to fight off sharks, and that responsible divers who follow the decompression tables can't get Bent, only fools who break the rules will cop it! (Don't worry DES, I'm only kidding!!)

The third well-known problem, nitrogen narcosis ("Raptures" to the ignorant peasants) is a bit trickier to handle. Divers going to depths of around 30 metres or more enter the realm of the esoteric and infamous "Narks", and funny things begin to happen.

In the warm, clear ocean waters of tropical regions, divers often report feeling elated at depth, enjoying the experience immensely. Likewise, people put under pressure in recompression chambers frequently have a great time, giggling and marvelling at their "Donald Duck" voices in the warm, secure confines of the chamber. However, such reactions seem to disappear totally when you substitute this relatively comfortable environment (in which you are dry, breathing normally and able to communicate clearly with others) with the cold, dark and often silty world of the waterfilled caves and sinkholes. Instead of euphoria, divers may experience negative and potentially very dangerous effects which need to be quickly recognised and carefully handled, not the easiest of things to do when you are heavily task-loaded.

The waterfilled sinkholes of the Mount Gambier region of South Australia are of special significance to me, and whilst they rarely provide me with cause to feel euphoric at depth, such experiences are nevertheless possible ... especially if you happen to see the stars shining through a mirror-calm surface at midnight in Piccaninnie Ponds from a depth of 33 metres! Although many sinkholes may contain crystal-clear water at depth, the limitations of underwater torches are such that the clarity generally cannot be fully appreciated and it is very much like doing deep ocean night-diving in many cases. Seeing stars or clouds from such depths underwater though may inspire feelings of genuine awe, and might in fact be little influenced by narcosis, who can tell?

During the past few years, I have undertaken nearly 200 cave dives to depths of 30 metres or more, and have encountered narcosis frequently enough to almost regard it as an unwanted dive buddy who is up to no good. Strangely, many of my cave diving companions