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Airway surgery – Past, present & future? *Prof Martin Birchall, London, UK*
Man, mannikin, manuscript: *Prof Steve Yentis, London, UK*
NAP4 the aftermath: *Prof Tim Cook, Bath, UK*

Programme topics on:

Airway Trauma: *Prof John Sakles, Tuscon, USA*
Ovassapian Memorial Session: *Prof William Rosenblatt, Yale, USA & Prof Carin Hagberg, Houston, USA*
New DAS Intubation Guidelines: *Dr Chris Frerk, Northampton, UK*
Oxygenation: *Dr Elizabeth Behringer, LA, USA / Dr Anil Patel, London, UK & Prof Andrew Farmery, Oxford, UK*
International Cases Presentations: *Dr Michael Kristensen, Copenhagen Denmark, Dr Paul Baker, Auckland, New Zealand (Co-moderators)*

Debates on:

RSI outdated? *Dr Irene Osborn, New York, USA & Dr Ellen O'Sullivan, Dublin, Ireland*
Which front of neck technique? – Surgical Airway: *Dr Richard Levitan, Philadelphia, USA*
One lung ventilation – DLT or endobronchial blocker? *Dr Edmond Cohen, New York, USA*

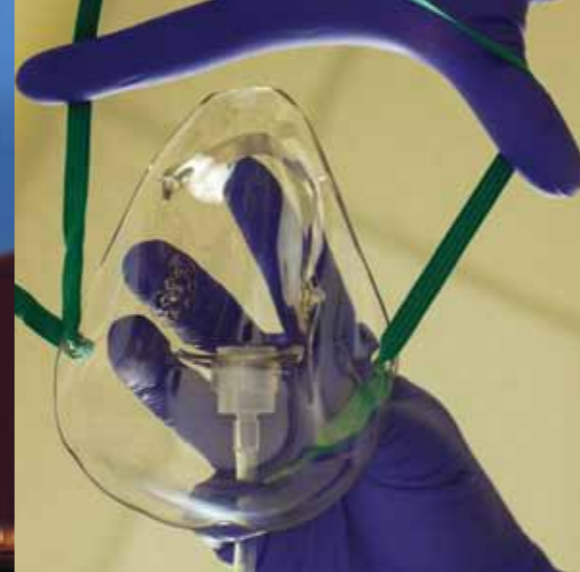
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Front of neck access

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DUBLIN



An oxygen reservoir for use in difficult environments

In isolated hospitals in poor countries supplies of both oxygen and electricity are frequently interrupted. This greatly inhibits the delivery of anaesthesia, oxygen therapy and controlled ventilation. In this short article, we discuss equipment which enables these difficulties to be overcome. A reservoir of pressurised oxygen is prepared locally and stored for use should oxygen and electricity become unavailable.

Introduction

In some of the world's poorest countries, oxygen is usually supplied in cylinders which may require transportation over great distances along roads which can be impassable for prolonged periods. It is therefore not uncommon for hospitals to be without oxygen for days or even weeks at a time.

In recent years the oxygen concentrator has provided an alternative source of oxygen which is not only less expensive but also less reliant on transport facilities. Furthermore, some concentrators have now been adapted to generate sufficient pressure to be able to also drive a ventilator.¹

An oxygen concentrator requires electricity and in many parts of the world the supply of electricity is also unreliable due to wide fluctuations in voltage and frequent interruptions in supply. The use of generators in these locations is common but there are reliability and maintenance issues as well as the high cost of fuel to be taken into account. As a result it is common practice for many hospitals in rural areas to limit the use of the generator to set periods each day.

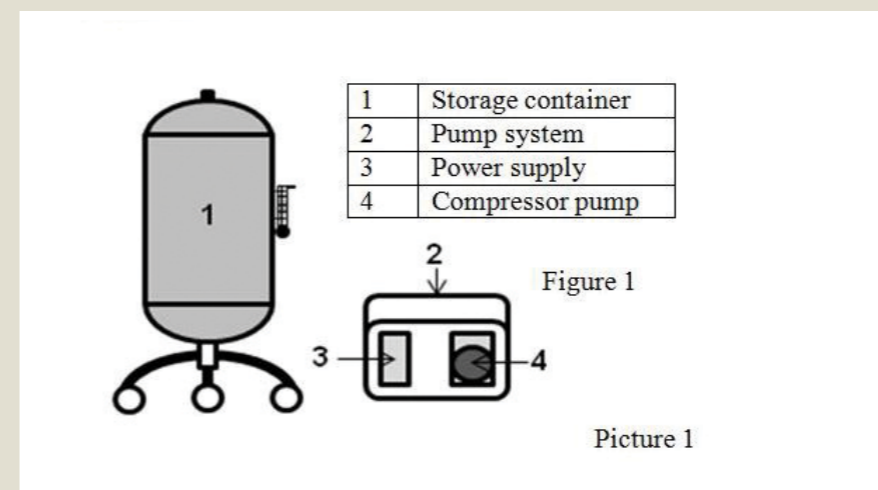
Description

We have developed an oxygen reservoir system which has been designed for use in combination with an oxygen concentrator so that oxygen is generated locally when electrical power is available and can also be stored locally to overcome intermittent power failures. Oxygen produced by the concentrator is subsequently pressurised to 5 bar and stored at that pressure. The pressure of 5 bar has been chosen as a level that is safe, easy to achieve and sufficient for driving a suitable ventilator.

The system is in two parts, the compressor and the storage container (Fig 1). The compressor consists of a small 12 volt pump and 12 volt power supplies from any mains or generator voltage between 85 and 290 volts. The system has a number of safety features including overpressure cut-off, flow restrictors to avoid over-demand from the concentrator and a flame guard fire safety device. The compressor is supplied in a rigid plastic case and has three connections which are located on the side of the case; the inlet connector from the oxygen concentrator, the outlet connector with a valve, leading to the storage container and the mains power lead connector.

The storage container is a cylindrical vessel made of aluminium, pressure tested and certified to 10 bar, supported on a rigid wheeled frame. Two standard sizes are available depending on the application, 20 litres and 100 litres. At a pressure of 5 bar they have storage capacities of 100 and 500 litres, respectively. The storage container utilises the same connection both for receiving oxygen from the compressor and for delivery of oxygen to an anaesthetic workstation. There is an additional outlet with a flow meter with a range of 0.5–5 l.min⁻¹ for oxygen supply to patients.

The oxygen inlet/outlet connection is located on the top of the container. It consists of a valve with a tube, through which the container receives the compressed oxygen directly from the pump and which automatically seals when disconnected from the pump. If the supply of electricity fails and the oxygen concentrator ceases to function, the reservoir can be used to deliver the compressed oxygen to a suitable anaesthetic workstation such as the Glostavent.² The ventilator drive on the this machine can function at any pressure down to 1.2 bar and utilises oxygen at a rate of approximately 1 l.min⁻¹. As the ventilator is designed to recover the drive gas and return it to the breathing circuit, the FiO₂ under these conditions is approximately 30% with no additional supplementation.³





As usual, this month's issue of *Anaesthesia* offers something for everyone and here I highlight important articles for obstetric, cardiac and orthopaedic anaesthetists.

The predictive ability of non-invasive haemodynamic parameters for hypotension during caesarean section: a prospective observational study

Yokose M, Mihara T, Sugawara Y, Goto T.

Caesarean section is commonly performed under spinal anaesthesia but it can result in hypotension leading to adverse effects in both mother and fetus. If we could identify those mothers likely to suffer from hypotension it may allow us to take preventative measures. A group from Japan have examined various pulse oximetry parameters and found that a relatively high pre-anaesthetic heart rate (>89 bpm)

was the only possible prognostic factor for hypotension associated with spinal anaesthesia. This is probably because patients with a high resting heart rate are more dependent on sympathetic tone to maintain blood pressure and the sympathetic blockade associated with spinal anaesthesia then leads to a greater reduction in blood pressure.

Haemoconcentration of residual cardiopulmonary bypass blood using Hemosep®: a randomised controlled trial

Hogan M, Needham A, Ortmann E, et al.

Surgery involving cardiopulmonary bypass is associated with haemodilution, activation of haemostasis and blood transfusion. Following discontinuation of bypass, the fluid within the circuitry, a mixture of the patient's own blood and any added fluid, is usually administered back to the patient. Hemosep® is a novel cell salvage system that can be applied to concentrate residual bypass blood after surgery. The Hemosep device consists of a blood bag which employs a chemical sponge technology and a mechanical agitator to concentrate blood-containing fluid; in this study the fluid drained from the tubing

and bypass machine. In a previous study it was associated with reduced postoperative bleeding and red cell transfusion. However residual blood from the bypass reservoir and circuit was discarded in the control group in that study, whereas it is usual to auto-transfuse this fluid. In this randomised study, Hogan et al. have shown that there was no difference between auto-transfusion of the remaining blood after bypass and concentration of the same blood using the Hemosep device before auto-transfusion. The authors concluded that they could not recommend use of the Hemosep for this indication in cardiac surgery.

Safety guideline: reducing the risk from cemented arthroplasty for hip fracture 2015

Association of Anaesthetists of Great Britain & Ireland, British Orthopaedic Association and British Geriatric Society

Cemented prostheses are preferred to un-cemented ones following hip fracture as they are associated with more pain-free mobility after surgery, a reduced need for re-operation and lower 30 day mortality. However, adverse cardiovascular events occur in about 20% of hip fracture operations in which a cemented prosthesis is used. It is more common in elderly men who have significant cardiopulmonary disease and are taking diuretics. This is a consensus document produced by

an expert working party in which guidelines are presented for the peri-operative conduct of both anaesthesia and surgery in patients undergoing cemented hemiarthroplasty. Recommendations include identification of patients at high risk of cardiorespiratory compromise, preparation of the team and the key intra-operative roles of both surgeon and anaesthetist.

C.R. Bailey
Editor, *Anaesthesia*

N.B. the articles referred to can be found in either the latest issue of *Anaesthesia* or on Early View (ePub ahead of print)

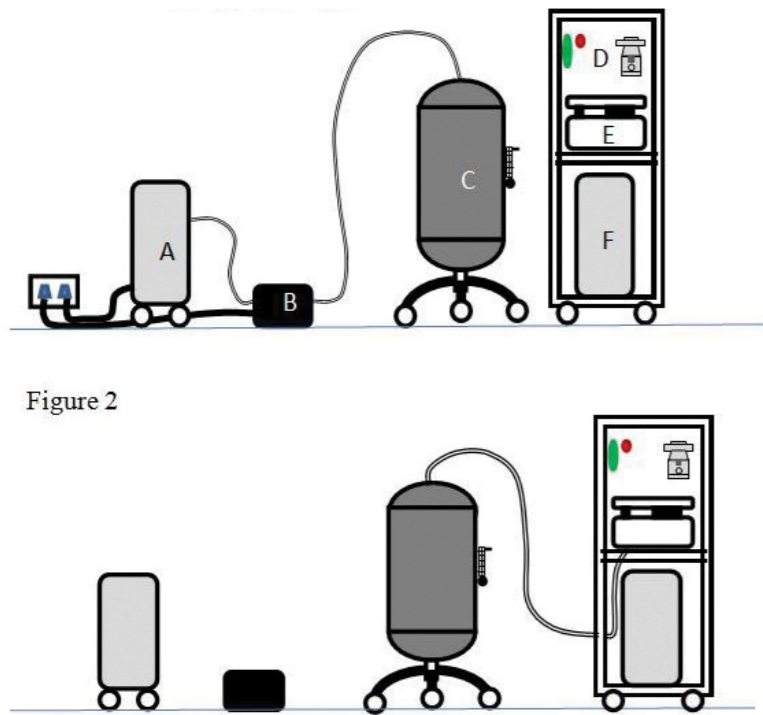


Figure 2

A	Oxygen concentrator
B	Diamedica reservoir pump
C	Diamedica reservoir vessel
D	Anaesthetic workstation
E	Anaesthetic ventilator
F	Integral oxygen concentrator

Use of the reservoir system

To obtain the maximum benefit from the reservoir system it should be used in combination with an anaesthetic machine which combines a gas driven ventilator with an integral oxygen concentrator (Fig 2). When electricity is available the oxygen concentrator is the source of both oxygen for the patient and pressure to drive the ventilator. If the concentrator is not required for patient use it can be used as a source of oxygen to fill the reservoir vessel. On leaving the concentrator, the oxygen is first directed to the compressor where the pressure is raised to 5 bar before it is fed into the vessel to form a reservoir of oxygen.

Using an 8 l.min⁻¹ oxygen concentrator the small vessel can be filled in less than 15 minutes and the large vessel in approximately 60 minutes. When the pressure of oxygen in the vessel reaches 5 bar the pump automatically stops, it is disconnected and the reservoir vessel is then ready for use.

The pressurised oxygen in the vessel can now be held in reserve for use if both electricity and oxygen become unavailable. When it is needed it is simply connected directly to the anaesthetic machine and can both drive the ventilator and supply supplementary oxygen. When in use, the pressure in the reservoir vessel will gradually fall. When it falls below 1.2 bar an audible alarm will alert the operator that the vessel needs replacing. A yoke system is also possible, whereby a number of larger vessels are combined into a single unit with a greater storage volume (Fig 3). This enables treatment to be continued in the extended absence of both oxygen cylinder supply and electricity.

Discussion

The provision of anaesthesia and controlled ventilation in isolated hospitals in poor countries can be extremely hazardous. The equipment used in modern hospitals in wealthy countries is generally unsuitable as it is dependent on uninterrupted supplies of compressed oxygen and electricity. It also requires regular attention from highly skilled engineers who are not readily available in these environments. Large scale oxygen generation and storage systems to over 100 bar are available but they are very expensive and difficult to maintain, with inherent safety risks such as explosion. Anaesthetic equipment is now available which has been specifically designed to function at lower pressures and in the absence of oxygen or electricity. However, although anaesthesia can continue, if both fail simultaneously the margins of safety are reduced.

The unique feature of the product we have developed is that it enables a reservoir of oxygen to be prepared locally at minimal expense and stored at a pressure sufficient to drive a ventilator. It can enable satisfactory provision of anaesthesia to be maintained long after conventional methods have failed and can increase safety in parts of the world where resources are limited and external oxygen supply is impractical or unavailable.

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Figure 3

