

Draw-over anaesthetic equipment



Fig 1. Servicing an OMV with Boyle's plant pot stand in the background. Sierra Leone 2001.



Fig 2. Incorrect use of draw-over equipment showing a large dead space between patient and expiratory valve which will lead to CO₂ build-up in the circuit.



Fig 3. Military TSAA demonstrating heavy valve system (and scavenging) at the patient end and the large number of connections.

The Association of Anaesthetists (AAGBI) has a long history of producing checklists and guidance on the safe use of anaesthetic equipment. *Checking Anaesthetic Equipment 2012* has become a widely accepted standard for checking the anaesthetic machine and allied equipment in the modern operating theatre [1]. The aim of the AAGBI draw-over anaesthesia working party was to produce a checklist that could be used in any setting with enough information in the accompanying glossy to ensure safe use of draw-over anaesthetic equipment. The minimum standard for checking draw-over anaesthetic equipment and other important auxiliary equipment, such as oxygen supply and suction equipment, should be the same wherever the anaesthetic is undertaken and the aim of the checklist is to make it applicable to all environments.

In Western medicine we have become very accustomed to the high fidelity, technologically advanced, temperature compensated plenum vaporisers to deliver volatile anaesthesia, which depend upon the reliable provision of high pressure oxygen and air, as well as electrical power. In comparison there has been little standardisation of checking draw-over anaesthetic equipment. In low and middle-income countries (LMIC), as well as forward military environments, draw-over anaesthesia is used extensively because of its simplicity and minimal logistic burden – running easily without power and with oxygen added via a concentrator or in small quantities from a stand-alone cylinder. Although in some LMIC there has been a move towards plenum vaporiser-delivered anaesthesia, the unreliable supply of high-flow oxygen and carrying gas has meant that draw-over equipment has continued to be the reliable alternative, a situation which is likely to continue for many

years. Sadly a large number of plenum based Boyle's machines have been donated over the years to LMIC without considering the logistic issues, and many slowly rust in corners, sometimes acting as expensive shelving units or even plant stands (Fig. 1).

Lack of standardised equipment, regular maintenance and guidance on checking can readily lead to the incorrect use of the equipment, which can lead to inconsistent volatile agent reaching the patient or build up of CO₂ in the circuit. During educational visits to LMIC, examples of incorrectly assembled draw-over equipment have been witnessed (Fig 2). The hope is that in conjunction with other safety checklists such as the WHO Surgical Safety Checklist [2] there will be an increased awareness of the importance of anaesthetic equipment checklists with an improved safety culture.

The UK military has depended upon the Triservice Anaesthesia Apparatus (TSAA) for over 40 years, which is based around the Oxford Miniature Vaporiser and has been used in a wide range of active duty environments with great success. The Oxford Miniature Vaporiser has a number of major drawbacks, especially for the occasional user. It has a small volume of volatile, lack of temperature compensation, large number of connections, which predisposes to disconnections, bulky valve system at the patient end and most importantly a lack of CE marking which prevents its use in the UK [Fig 3]. In addition, from the military perspective, recent conflicts with established logistic chains from other nations have allowed plenum based-anaesthesia to be predominantly used, which has severely limited draw-over experience for anyone deployed in the military over the last ten years.

A strategy which has been driven by the military but would also benefit volunteers to LMIC would be to have a CE marked draw-over anaesthesia equipment so service and volunteer personnel could become familiar with this form of equipment before travelling. As a result, over recent years, the British military has evaluated a variety of options to replace the TSAA. The agreed solution has been to procure the Diamedica DPA02, which is to be taken through the CE marking process by Diamedica. A CE marking increases the possibility of allowing it to be used in NHS environments in the future. One of the initial steps to make this a possibility, supported by the President of the Royal College of Anaesthetists and the President of the Association of Anaesthetists, was to produce a draw-over specific equipment checklist so that a suitable equipment check could be safely performed in the same way as those performed daily on modern anaesthesia workstations.

The challenge for a checklist was to create a functional and familiar document that would add benefit to the daily checks and increase safety – especially if the equipment or environment itself was relatively unfamiliar to the anaesthetist. The template which was used, with permission, was the AAGBI equipment checklist. This was developed and extended to include a 'glossy' with direct support from the Association by initiation of a working party. This comprised representatives from the Association, the military, industry, Medicines and Healthcare products Regulatory Agency and experts in anaesthesia for LMIC. In particular, the addition of a new column to highlight specific resource limitations, to be raised at the Team Brief, was felt to be an essential aspect of a checklist which should be used in resource constrained environments.

Further educational materials are referenced within the glossy and include the e-anaesthesia module for draw-over anaesthesia.

The checklist is soon to be published, and the military is starting to train on the use of the Diamedica DPA02 on the Defence Anaesthesia Simulation Course. The next step will be to negotiate the introduction of draw-over anaesthesia using the DPA02 into a number of NHS environments – sponsored by military consultants. The Diamedica DPA02 (and DPA03) is extensively used by aid agencies as well as LMIC, so training in the UK will benefit the military as well as, potentially, anaesthetists heading out to LMIC or as disaster relief volunteers.



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References

1. Hartle A, Anderson E, Bythell V, et al. Checking Anaesthetic Equipment 2012. *Anaesthesia* 2012; **67**: 660–8.
2. Haynes AB, Weiser TG, Berry WR, et al. A surgical safety checklist to reduce morbidity and mortality in a global population. *New England Journal of Medicine* 2009; **360**: 491–9.