

Field Anaesthesia Training for the Australian Defence Force

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Group Captain George Merridew was Chair of the ADF's craft group in Anaesthesia from 2000 to 2004. He has convened 10 field anaesthesia courses in Launceston, Tasmania, where he is in civilian practice. GPCAPT Merridew graduated from the University of Tasmania in 1972. After Permanent Air Force service from 1970 to 1979, he trained as an anaesthetist in Adelaide and qualified FFARACS (now FANZCA) in 1983. From 1983 to 1985 he continued his post-Fellowship experience in the UK, Hong Kong and the USA. He settled with his family in Launceston, where his clinical interests have included Pain Medicine, ICU, medical retrieval and field anaesthesia teaching. GPCAPT Merridew has deployed with the ADF in Irian Jaya, Rwanda, Bougainville, East Timor, Bali and Iraq.

Conventional anaesthetic training is not sufficient for field environments

Anaesthesia for surgery must be effective and safe. The patient's risk from surgery and anaesthesia must be less than from expectant management.

Some deployments conform with the conditions in metropolitan Australian hospitals, where preoperative patients are healthy and well-assessed, the surgery is elective and there are reliable anaesthesia apparatus, drugs, monitoring devices, air conditioning, electricity, suction, compressed gases and skilled assistance.

Other deployments involve unstable, poorly investigated non-English-speaking patients having emergency surgery to save life or limb. The ADF anaesthetist may have limited choices: general anaesthesia with parenteral ketamine or a drawover inhalational agent, positive pressure ventilation rendered by a self-inflating bag's ambient air $\pm$ added oxygen; and no electronic monitoring. Operating room temperatures can range from near freezing to over 40 degrees Celsius.

Western civilian anaesthetic training occurs in hospitals which adhere to national regulations for operating rooms and other hospital environments. Most Third World hospitals and field situations are far removed from such standards.

The history of Australian courses in field anaesthesia

In 1985 and 1984 respectively anaesthetists Haydn Perndt and George Merridew attended the annual Anaesthesia in Developing Countries 5-day course in Oxford, UK. In 1999 an Australian equivalent was established, entitled: Remote Situations, Difficult Circumstances, Developing Country Anaesthesia (RSDCDCA) course. Dr Perndt (later SQNLDR, RAAF SR) ran the inaugural RSDCDCA at the Royal Hobart Hospital assisted by then-WGCDR Merridew and several civilian anaesthetists with substantial South Pacific Island experience. The 1999 course had 16 'students'; all were specialist anaesthetists. Eight ADF Reservists were either students or faculty. The RSDCDCA course has been held annually since, for civilian 'students'. In 2000 a similar course but with a military bias for the ADF was commenced and referred to as the Military Anaesthesia (MILAN) course. Altogether 112 ADF members have attended an Australian field anaesthesia course; 96 of those attending a MILAN course. Eighty four of those 112 still serve in the ADF. The participants include:

- 15 anaesthetic registrars in training
- 4 intensive care physicians (FRACP FJFIMJ)
- 4 General Duties Medical Officers
- 5 Nursing Officers
- 2 Medical Assistants
- 5 Allied Forces personnel: 4 USN and 1 Canadian Armed Forces
- 12 other ADF anaesthetists, now-retired

Twelve anaesthetic consultants (mostly members of the ADF) have attended as faculty, assisted by 9 civilian registrars with drawover experience.

Since 1991, the author has undertaken extensive bench testing of field anaesthesia apparatus in the Launceston General Hospital (LGH). That testing has included ADF, UK and US military and civilian anaesthesia vaporisers, examining their performance in the range of ambient temperatures and gas flows conceivable for surgery in the field. Also examined were oxygen delivery to the patient and the apparatus' resistance to gas flow especially in the drawover mode of use.

Military anaesthetists are more versatile if trained in the drawover technique, especially relevant to comparatively austere ADF surgical facilities such as in Bougainville, East Timor and Banda Aceh.

What is the 'drawover anaesthesia' technique?

The drawover technique delivers controlled concentrations of oxygen and anaesthetic vapour. It involves:

A vaporiser of low resistance to gas passing through it (the carrier gas), such as the Oxford Miniature Vaporiser in the ADF's Field Anaesthesia Machine

The carrier gas is ambient air ($\pm$ supplementary O_2). Carrier gas flow is generated by the patient's inspiratory effort, or by a self-inflating (Laerdal or Ambu) bag filling from the circuit between the vaporiser and patient.

A non-rebreathing circuit, typically using a Laerdal valve at the patient end. None of the patient's expired gas enters the drawover circuit hose between the vaporiser and patient (unlike the ubiquitous 'circle' circuit of Western hospitals) so it does not dilute vapour or oxygen coming from the vaporiser to the patient.

Supplementary oxygen is fed into a 'reservoir tube' of 400-500 mls volume open to atmosphere and attached to the vaporiser's upstream side. Oxygen enters at the reservoir-vaporiser junction; flows of 0, 1 and 4 litres/minute give inspired oxygen concentration (F_{iO_2}) of 21%, 30-40% and 60-80% respectively.

Designing the Australian field anaesthesia courses, civilian or military

Anaesthetists won't use inhalational techniques unfamiliar to them, a key fact addressed by the courses.

RSDCDCA and MILAN courses emphasise drawover anaesthesia for three reasons:

1. It is the safest inhalational technique for surgery in settings with unreliable supply of oxygen and/or electricity.
2. Few Australian anaesthetists have used drawover apparatus.
3. In the field or anywhere else, the drawover circuit ($\pm$ its vaporiser) reliably supports oxygenation and ventilation, whether for inhalational or totally intravenous anaesthesia, for problematic local anaesthetic blocks and for respiratory resuscitation.

The courses have lectures on the performance of drawover apparatus. Each 'student' uses the drawover technique on consenting patients, supervised by drawover-competent faculty. Students are observed by their colleagues, in groups of three or four per operating room. Standard patient monitoring is used, and highlights the inspired oxygen and anaesthetic vapour concentrations. Isoflurane is the main agent used, with lesser emphasis on sevoflurane. Diethyl ether is not used.

Few patients decline the invitation to participate and those who do refuse use the grim words: "I was told I would be having a spinal". The host hospital surgeon or anaesthetist of the case can veto the patient's participation, a rarity in over 500 cases.

The host State medical board registers course members for the period of the course. Each course has been supported not only by the hospital's clinicians and administrators but also the respective councils of the Australian Society of Anaesthetists and Australian and New Zealand College of Anaesthetists

(ANZCA). "Students" and faculty gain credits in ANZCA's Continuing Professional Development process.

The original course design has remained substantially unchanged. It includes:

- Drawover technique in theory and practice
- Comparing drawover and other inhalational anaesthesia systems
- Ketamine anaesthesia
- Local infiltration, peripheral nerve blocks and spinal anaesthesia
- Pain relief after surgery or other trauma
- Ventilators, suction systems, monitors and oxygen concentrators
- Sterilisation of instruments and other equipment
- Obstetric and paediatric anaesthesia
- The difficult airway
- Intensive care
- Medical retrieval by air and land
- Cultural aspects of medical care
- Ethical issues: the allocation of limited resources
- Mass casualty management
- Personal hazards to the deployed anaesthetist and his/her family
- Motivations for deployment
- Personal accounts by deployed anaesthetists
- Psychological adaptation to a new environment
- International civilian aid

The ADF's field anaesthesia course

The basically civilian RSDCDCA course in 1999 was heavily over-subscribed by civilians; it continues to be so. If even four places on an annual such course of 16 'students' were quarantined for the ADF it would take 20 years for the 80 current ADF anaesthetists each to attend. Consequently, in 2000, ADF courses were begun, in Launceston. Similar courses have been conducted at LGH almost annually until 2007, with the support of the ADF's Joint Health Commander.

The duration of ADF courses has been three days. Its military bias includes:

- The ADF's ULCO field anaesthesia machine
- FAST and other ultrasound techniques
- Shipboard resuscitation, anaesthesia and intensive care on HMAS MANOORA and HMAS KANIMBLA
- Organisation of ADF health facilities, and routines on deployment
- Contrasting patterns of injury in various deployments such as Rwanda, East Timor and the Middle East
- Anaesthesia, intensive care and aeromedical evacuation in the ADF
- Personal accounts of deploying
- Emotional reactions to deployment, during and afterwards

- Implications for families of deployed anaesthetists

The ADF course assumes 'students' have a comprehensive knowledge of anaesthesia and targets ADF Reservist anaesthetists either holding or preparing for the FANZCA. Many are ex-Regular Forces medical officers with much relevant military experience. By late 2009 only about 12 ADF anaesthetists have yet to participate. Also targeted are:

- ADF Reserve intensive care physicians holding a medical specialist qualification (FRACP)
- ADF Reserve and Regular Nursing Officers and Medical Assistants who train ADF theatre technicians
- Senior ADF Medical Officers, especially hospital commanding officers
- Health staff from allied forces, especially US Navy Medical Logisticians on exchange posting to the HMAS MANOORA-KANIMBLA project.

Potential Changes to the ADF courses

Should we hold the course in an ADF hospital? Although somewhat attractive, such a change would be impractical because ADF hospitals have too few operating rooms to provide the key clinical experience in drawover anaesthesia.

Can clinical drawover use be replicated by simulation training? Simulation would eliminate the 'hands-on' element central to training with inhalational apparatus. Human patients are likely to remain a feature of the ADF course.

Should drawover training be abandoned entirely? Recent operational health deployments have involved well-resourced multinational surgical facilities treating mainly severe multiple trauma from high-energy bullets, roadside bomb blasts and burns. Drawover anaesthesia has not been used by ADF personnel working in such facilities.

Will the ADF ever again deploy a low level surgical facility like the Combined Medical Element (CME) of Bougainville, an RAAF Fly Away Surgical Team or an RAAMC Parachute Surgical Team? Yes.

Is servicing and resupply reliable for any deployed ADF surgical facility? No.

Should the ADF field anaesthesia course include extensive teaching about damage-control surgery and the aggressive management of severe trauma-related coagulopathy? No. Detailed teaching on this should be confined to external civilian courses.

Should the ADF course include extensive teaching of peripheral infusion local anaesthesia invaluable in awake ICU or AME trauma patients? No. This should again be restricted to external civilian courses..

Conclusion

The ADF's field anaesthesia training should continue in its present design, to evolve as circumstances require.

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