REVIEW

MILITARY INTENSIVE CARE PART 2. CURRENT PRACTICE

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Introduction

Military critical care faces challenges not encountered in routine civilian practice. Infrastructure issues were discussed in a series of articles published in Current Anaesthesia and Critical Care in 2002 and 2003 (1-4) but will be considered here briefly.

Infrastructure

Field Hospital ITUs are configured to be in tented accomodation This means they are relatively easy to move and can be rapidly set up. Amongst the many problems associated with this, perhaps the most important is that of environmental control. In 2003, 34 Fd Hospital ICU reported temperatures of over 40ºC. Sand blew into the tents easily and the unit had to be damp dusted twice a day to control this. It is therefore a clear early priority to put intensive care facilities into semi permanent structures, as soon as the tactical situation allows. Both the current (2007) deployed ITUs are in 'tier 2 accommodation' (i.e. portacabins). The utility of the Primary Casualty Receiving Facility to provide off shore maritime support when appropriate alleviates many of these issues due to the full infrastructure support to clinical areas which is integral to the ship.

Resources

Critical care needs resources (power, water, lighting, drugs, equipment and consumables). In a deployed military situation these are supplied by a logistic system. Water implies water tankers. Power implies generators which in turn need fuel and maintenance. Blood products need a reliable cold chain. Medical supplies in a deployed situation are competing with combat stores for space on aircraft, ships and vehicles. Electrical supply can not always be guaranteed. High pressure oxygen via pipelines is not practical in most situations. Oxygen must be provided from cylinders which are logistically resource intensive to supply (and present an explosive hazard), or from oxygen concentrators. Military intensive care has to be delivered with these restrictions in mind and equipment choice has to reflect this.

The equipment used in field ITUs has to satisfy several competing needs. It must be robust, easily transportable and able to function in extremes of weather. It must also be technically accurate and of a similar standard and range as in the UK. It must have a battery backup and/or be capable of working from alternative power sources.

Ventilators

Current field hospital intensive care units use the T Bird VS Ventilator (Bird Products Corp, Palm Springs Ca). This has its own internal compressor and is not dependant on high pressure gases. Air entering the compressor can be supplemented with oxygen. It is of note that the maximum concentration of oxygen that can be provided using the low pressure inlet is 55 % at 5 litres per minute, or 70 % at 10litres per minute. This may result in an early recourse to using high PEEP or reversing I: E ratios in some patients. This ventilator also has internal and external batteries, which will last up to 45 minutes and around 3 hours respectively in the event of mains failure.

The TBird VSO$_2$ has similar features as the VS model but utilizes a pressurized O_2 source with internal blender allowing precise FiO_2 settings.

Oxygen

The mainstay of oxygen supply is from De Vilbiss oxygen concentrators (Sunrise Medical Respiratory Products, Somerset, PA, USA). These function well in the desert environment, but do not have an internal battery. They are also limited by the fact that the highest oxygen flow they will generate is about 5 l/min, giving an FiO_2 of about 50%.

Monitors

The Datex – Ohmeda S5 monitor system is used (Instrumentarium Corp, Helsinki, Finland) both in the operating theatre and intensive care. This lightweight monitor has the capacity for basic non invasive monitoring, as well as 2 invasive monitoring channels and a side stream gas analyser. This is invaluable in the operating theatre where a draw over Tri Service Anaesthetic apparatus is used, but the capacity to measure end tidal carbon dioxide has proved useful on the Intensive Care Unit as well.

Syringe drivers

The Braun Perfusor Compact (B.Braun, Melsungen, Germany) is the current syringe driver. It is light weight and easily portable and can function with AA batteries ensuring sustained power. Syringe drivers are the method of choice for delivering inotropic support and other essential infusions.

Patient warming

Despite the ambient day time temperatures in the desert being in the order of 40ºC to 50ºC, severely injured casualties in the early part of the 2003 Iraq conflict often arrived at the Field Hospital hypothermic. Some of this was attributed to airflow over the casualties during helicopter evacuation and some due to casualty movement at night. For resuscitation in the ED, OR and ICU, Bair Hugger (Augustine Medical Inc, Eden Pairie, MN, USA) warm air systems and Hotline Infusion Systems (Sims Level 1 Inc, Rockland, MA, USA) to warm fluids have been effective.

Near patient testing

Near patient testing of blood gases is done using the iStat system (Abbott Point of Care, Illinois USA). This has been useful, but the cartridges are affected by extremes of temperature.

Personnel

Military clinical personnel have to be able to live in the potentially austere military environment, understand the

restrictions on care inherent in the deployed military environment and function under threat. Military doctors and nurses are trained to the same high clinical standards as their civilian colleagues. Intermediate training in Intensive Care Medicine is required for all RAF anaesthetists who participate in aeromedical evacuation and the military have an increasing number of advanced trained or dual CCT consultants. With the closure of military hospitals, military consultants now work alongside their NHS counterparts and have to meet the same standards of CPD and appraisal.

Military ICU nurses complete the same ICU training as their NHS counterparts with many gaining experience or dual training in other areas of critical care practice including burns, neurosurgery and outreach. Nurse manning is structured to provide a 1:1 ratio for level 3 patients and 1:2 for level 2, although a degree of flexibility is required during times of increased medical activity. Manning numbers are tailored to meet specific operational theatres based on the tempo of operations and evacuation capability, particularly where the care of the local population is a feature.

Patient population

Field intensive care units are equipped to provide intensive care to servicemen for a short period of time prior to evacuation. The target population is predominantly young fit patients, prescreened to ensure the absence of chronic disease (different from the average NHS unit).

Early warning systems such as MEWS have been developed for an older population and do not translate well to a younger population. The fit and relatively bradycardic soldier may either trigger the system unnecessarily or not trigger at all when he is becoming seriously unwell. 76 % of the MEWS scores which triggered a response at the UK MED GRP Field Hospital in Shaibah, Iraq in 2005 were to fit healthy patients with no signs of critical deterioration [6].

The case mix is very different from NHS practise. There is a far higher proportion of penetrating ballistic injury, and depending on the weapon systems being used, burns. There are also environmental diseases to consider including heat injury.

There have been many occasions where the intensive care units have supported the local populations including children. This causes issues with equipment, not least as the original scaling for ITUs in the Field had no paediatric equipment.

Onward movement of civilians often proves difficult and such patients have had ICU stays of over 30 days, requiring drugs and treatments (e.g. TPN) not usually required for the military casualty. This also potentially depletes resources for incoming military patients. Complex clinical and ethical dilemmas can result centring on whether these patients should be discharged to a host nation medical facility (where the care may not be to a UK standard), or kept in the Field Hospital, depleting the assets available to the military and possibly creating a culture of dependency in the local population. This is explored further in reference 5.

Conclusions

Critical Care/Intensive Care is a young speciality and continues to evolve and develop. Critical care was awarded the status of a speciality in its own right in the UK in June 1999 [7]. One of the developments described by Saxon et al [7] is the change in emphasis from *'the intensive care unit as a location in which to gather critically ill patients towards intensive care medicine as an evidence and knowledge base directed at providing for the critically ill throughout the hospital'.*

The DMS is providing this approach across the battle space, not just the hospital, by deploying consultant led MERT (REF), practicing DCR in the ED and providing seamless critical care from the prehospital arena through the ED, OR, Hospital ICU and evacuation by the RAF CCAST.

Despite the many challenges of providing Intensive Care in the Field to a standard acceptable in the UK, recent experience in Iraq and Afghanistan has shown it possible. There remain issues to be resolved and advances to consider and these will be discussed in the final paper of this series.

References:

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