

# PAEDIATRIC INTENSIVE CARE IN THE FIELD HOSPITAL

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## Abstract

Our recent experience of paediatric critical care during UK military operations in Afghanistan is discussed alongside consideration of the background to the paediatric critical care service on deployment. We describe the intensive care unit's capabilities, details of recent paediatric critical care admissions during July to September 2008 and some of the ethical issues arising. Some desirable future developments will be suggested.

## Introduction

The provision of medical support to military operations inevitably leads uniformed medical services to encounter injured civilians. This is both a historical and current experience. Civilian casualties are drawn from all age groups, including children. Critical care support is expected for all casualties, who are brought into the military chain of evacuation, and whose clinical state requires it. This includes children of any age.

## Historical experience

The necessity for military medical services to provide medical care to children in a resource limited environment is not a recent phenomenon [1]. Modern conflicts have consistently given rise to paediatric injuries.

UK Defence Medical Services have treated injured children in recent conflicts [2,3], as have the medical services of allied nations [4]. As critical care has become an integral part of modern military medical care, this has given rise to the expectation that critically injured children will also receive critical care support.

The treatment of injured children in UK military medical facilities is consistent both with UK Defence Policy for Civil-Military Co-operation and International Humanitarian Law. The UK is also a signatory to the UN Convention on the Rights of the Child, which requires belligerents to take all feasible measures to ensure protection and care of children who are affected by an armed conflict. Medical care of children injured due to the conflict is implicit.

There are however very few published articles referring to paediatric critical care in the field environment. The recent wars in Iraq and Afghanistan have given rise to paediatric casualties requiring critical care support. Many of these children have been evacuated to uniformed services hospitals, and so there is an evolving base of experience in their care.

## Mission

As part of the combat formation, the military field hospital has a clearly defined military mission. The nature and scale of the deployed medical assets is drawn directly from careful analysis of the mission. An example of a recent mission statement of the UK Joint Force Medical Group on Operation HERRICK, is *"The Joint Force Medical Group is to provide appropriate healthcare support to: UK personnel including Other Government Departments (OGD), Coalition Forces (CF) and when required the Enemy, to Government of Afghanistan (GoA) security institutions when deployed in Combined Operations and as*

*directed by the relevant eligibility matrix to contractors and Afghan civilians, in order to support security improvement and the establishment of governance within Helmand and increase the capability and capacity of GoA security institutions".*

The requirement to provide appropriate medical support to Afghan civilians, according to the eligibility matrix, is unambiguous. It is accepted that life saving treatment should be provided to the highest standard, where life is at risk. Life is of course at risk in all critically ill or injured patients. It therefore follows that paediatric critical care is part of the military mission.

## Location and physical circumstances

Critically injured children are managed in the field hospital intensive care unit, alongside adults. There is no separate facility. The facility is either in tents or in a pre-fabricated building. Climate control is vital so it must have reliable air conditioning, be well lit and have hot and cold running water. Noise from without may be intrusive. Adult beds are used, and much of the equipment is suited equally to adults and children (e.g. syringe drivers), or requires only minimal adaptation (e.g. suction units, requiring paediatric Yankauer suckers). The UK military intensive care module now contains paediatric disposables, and specific items can generally be obtained quickly, where they are not held.

The intensive care unit is situated close to operating theatres. This allows swift transfer and uninterrupted resuscitation.

Unlike a paediatric intensive care unit in the UK, the facility is not equipped with children's toys or pictures. Nevertheless, as critically injured children recover to consciousness, it is possible to improvise an environment familiar to a child, with toys sent by UK well wishers.

## Capability

### *Capacity and manpower*

Capacity is limited by the number of beds, although most field hospitals have a 'surge' capacity built into the manning, to afford some flexibility.

The ICU at Camp Bastion, Afghanistan, for example, is equipped and manned to provide a critical care capability of two level 3 and two level 2 beds, using these terms as standard definitions. The facility may surge to three level 3 and three level 2 beds, for a period of 48 hours.

Nursing manpower is provided from regular and territorial trained nurses, reinforced by civilian nurses from Contract for Logistic Support (CONLOG) organisations. All have either critical care training or experience. Paediatric experience is not usual.

Medical manpower consists of at least one full time consultant intensivist, with reinforcement from both junior and consultant anaesthetists during busy periods. Again specific paediatric intensive care training is not usual.

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## Organ support

All usual organ support is possible, except renal replacement, which the field hospital does not presently offer.

Invasive respiratory support is provided for children, using the T Bird AVS or VSO2 ventilators (Bird Products Corp) in pressure control mode. These are suitable for children of 10kg or greater. For smaller children, an improvisation has been used in the past to create a leak in the ventilator circuit [5]. Non-invasive ventilation is not offered.

Circulatory support is available with vasoactive drugs, dobutamine, noradrenaline and adrenaline being used most frequently. A full range of resuscitation medications are available. Dose calculations are not made using a standard paediatric template, but are at the discretion of the intensivist. No invasive cardiac output monitoring is used, either for adults or children.

Blood products are readily available, and frequently used. Nutrition can be provided by both enteral and parenteral means. There is no capability for individualised parenteral feed preparations, only standard adult formulations. Enteral feed is also a standard adult preparation. A full range of appropriate anti-microbials is available.

## Training

### Medical training

Specialist training in paediatric critical care medicine is not a requirement for any of the current consultant appointments in the field hospital. There is no deployed paediatrician. The consultant intensivist in the UK field hospital will ideally have dual CCT in adult intensive care medicine and a base speciality, generally anaesthetics. The specialist training programme, which leads to this CCT, may offer a period of up to three months in paediatric intensive care medicine, as part of the intensive care step 2 year. This would be instead of three months of adult intensive care medicine. Many civilian adult intensivists, who intend to practise in major centres, would not regard paediatric critical care training as necessary, because they will be co-located with a paediatric critical care facility. The military intensivist however will certainly be challenged by paediatric critical illness. Furthermore, Article 3/3 of the UN Convention on the Rights of the Child, expressly requires that medical care of children must be delivered or supervised by someone with appropriate paediatric training. There is therefore a strong case for incorporating paediatric critical care training into the specialist training programmes of all military intensivists, and encouraging a UK practice which includes critically sick children.

### Nurse training

Historically there has been no requirement for military intensive care nurses to be qualified or experienced in paediatric critical care. The arguments for specialist training and experience are no different than those for doctors. As fewer and fewer general intensive care units routinely manage both adults and children, the opportunities for routine experience in both will continue to dwindle. In the light of this challenge, two changes to the training and practice of military intensive care nurses are being introduced. Military nurses can now undertake ongoing training in paediatric intensive care as part of their professional development. It is also intended that, as part of specific pre-deployment preparations, intensive care nurses will have a period of work in a paediatric intensive care unit alongside civilian nurses. The intention is that one nurse per ICU shift will have the necessary training and experience to provide paediatric critical care. An acute paediatric care programme is also being established to improve the breadth of experience throughout the hospital.

## Specialist consultation

There are currently no formal arrangements allowing deployed doctors to consult paediatric critical care specialists in the UK. Such arrangements do exist for a number of other specialities, for example microbiology, radiology and neurosurgery, and would be of value for paediatric critical care.

## Recent experience

Paediatric intensive care admission data are presented for the intensive care unit at Camp Bastion field hospital, during the period 20/07/08 to 15/09/08, a period of 58 days. Anonymised data items were recorded contemporaneously. 15 children were admitted to the intensive care unit between these dates with an age range of 6 months to 17 years (median = 6 years). One child was discharged from intensive care to the ward and then re-admitted twice. There were therefore 17 paediatric admission episodes.

The duration of admission ranged from 1 to 16 days, with a median duration of 2 days. One child was admitted with spider bite anaphylaxis and one with domestic burns. The remainder had suffered penetrating trauma wounds, either from gunshot or explosive fragmentation, sometimes accompanied by burns or blast effect.

There was one paediatric death in the intensive care unit. This 18 month old child suffered a penetrating fragment injury to the upper abdomen and chest. After 16 days of ventilatory support, there was an ongoing requirement for vasoactive drugs due to septic shock, acute renal failure, malabsorption, coagulopathy and no prospect of abdominal closure for the foreseeable future. A consensus decision was taken to discontinue mechanical ventilation.

## Intensity of workload

The workload intensity data are presented in Table 1.

Intensive care unit bed occupancy	Level 3 days	Level 2 days	Level 1 days	Total bed occupancy
Children	38	23	1	62
Adults	100	41	5	146
All admissions	138	64	6	208

Table 1. ICU bed occupancy over the 58 day study period.

On 38 of 58 days (66%), there was at least one critically ill child in the intensive care unit, and on one occasion, there were four simultaneously, three of whom were ventilated. Paediatric admissions accounted for 30% (62/208) of all bed occupancy. The mean paediatric bed occupancy was 1.1 beds per day (62/58). This represents a substantial proportion of measured critical care activity.

The period described required significant paediatric critical care provision, both in numbers and intensity of treatment. Not reflected in the intensity figures is the fact that the service was provided by professionals, whose normal practice is not paediatric critical care. The most obvious consequence of this is that interventions were generally undertaken by two people, either two nurses, or a nurse and doctor, in order to minimise the risk inherent in unfamiliar practice. This increased the work intensity of the facility, without being reflected in the figures. Several paediatric critical care admissions were protracted. It is important to recognise that the original concept of forward based field critical care depended upon short duration admissions, preferably less than 48 hours, and swift rearwards evacuation to a facility offering definitive treatment [6]. This remains the accepted role of field critical care for coalition casualties. For critically injured civilian children however, rearwards evacuation is not usually possible, therefore the hospital has to respond by offering prolonged ICU admission. This has inevitably increased the demand placed upon the critical care resource.

## Ethical issues

### *Sustainability of paediatric critical care*

Paediatric critical care is presently being provided by UK Defence Medical Services to children, injured in the conflict in Helmand Province, Afghanistan, and has been provided in Iraq during the recent conflict there. Among the informing principles of military medical assistance to conflict situations, is the concept that all health care interventions should eventually be sustainable by the host nation [7]. This must be regarded as a long term ambition, as far as paediatric critical care is concerned, as the supporting infrastructure is not well developed. It is therefore likely that there will be a lasting expectation that uniformed medical services provide paediatric critical care, perhaps beyond the deployment of UK forces.

### *Lines of evacuation*

Paediatric critical care admissions presently constitute a significant part of critical care activity. Admissions are sometimes protracted. There is often no facility within the host nation to which children requiring multi-organ support can be transferred, without risking a significant deterioration in their standard of care. There is usually no agreement for rearward evacuation to the UK. Clearly by providing paediatric critical care, the capacity of the intensive care unit to admit adult casualties can be limited. The obvious conflict here is somewhat eased by the ability to provide a temporary surge in capacity.

### *Local provision*

As security within the host nation improves and infrastructure develops, it is to be hoped that paediatric critical care provision will become available. As this occurs, uniformed medical services facilities can adopt a holding policy for critical paediatric casualties, which is similar to coalition casualties. Safe transfer can already be provided by forward based CCAST.

## Future developments

### *Specialist training*

There is a clear need for military critical care doctors to have paediatric critical care training and ongoing experience. This could be provided through the dual CCT programme in Intensive Care Medicine or post CCT fellowships, and the integration of paediatric intensive care sessions into UK based consultant job planning.

## *Standard Operating Procedures (SOPs)*

Despite paediatric training military intensivists will always, and rightly, be adult critical care specialists. Our primary purpose is to support critically injured UK military personnel. Consequently paediatric critical care will never be routine. It is therefore important that a set of common paediatric critical care guidelines are developed, which can be exercised prior to deployment. It is equally important to have a system of 'on call' civilian consultants in paediatric intensive care medicine, for remote advice.

## Conclusions

Care of the injured child is increasingly a part of military critical care in the 21<sup>st</sup> century. This challenge has been met with enthusiasm, innovation and flexibility on the part of experienced military critical care professionals, allowing a high standard of care to be offered. This must now be followed by a more formal recognition of paediatric critical care as a military requirement, accompanied by training and guidelines to support best practice.

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