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Management of children in the deployed intensive care unit at Camp Bastion, Afghanistan

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ABSTRACT

Background The deployed Intensive Therapy Unit (ITU) in the British military field hospital in Camp Bastion, Afghanistan, admits both adults and children. The purpose of this paper is to review the paediatric workload in the deployed ITU and to describe how the unit copes with the challenge of looking after critically injured and ill children.

Methods Retrospective review of patients <16 years of age admitted to the ITU in the British military field hospital in Camp Bastion, Afghanistan, over a 1-year period from April 2011 to April 2012.

Results 112/811 (14%) admissions to the ITU were paediatric (median age 8 years, IQR 6–12, range 1–16). 80/112 were trauma admissions, 13 were burns, four were non-trauma admissions and 15 were readmissions. Mechanism of injury in trauma was blunt in 12, blast (improvised explosive device) in 45, blast (indirect fire) in seven and gunshot wound in 16. Median length of stay was 0.92 days (IQR 0.45–2.65). 82/112 admissions (73%) were mechanically ventilated, 16/112 (14%) required inotropic support. 12/112 (11%) died before unit discharge. Trauma scoring was available in 65 of the 80 trauma admissions. Eight had Injury Severity Score or New Injury Severity Score >60, none of whom survived. However, of the 16 patients with predicted mortality >50% by Trauma Injury Severity Score, seven survived. Seven cases required specialist advice and were discussed with the Birmingham Children's Hospital paediatric intensive care retrieval service. The mechanisms by which the Defence Medical Services support children admitted to the deployed adult ITU are described, including staff training in clinical, ethical and child protection issues, equipment, guidelines and clinical governance and rapid access to specialist advice in the UK.

Conclusions With appropriate support, it is possible to provide intensive care to children in a deployed military ITU.

INTRODUCTION

For the last 11 years, British Armed Forces have been deployed to Afghanistan with the International Security and Assistance Force (ISAF). Camp Bastion was built in Helmand Province in 2006 as the major British logistic base to support the operation and since its inception has included a Field Hospital; initially a tented facility, since 2009 the hospital has been built on hard standing. It consists of an Emergency Department (ED), Operating Theatre, Intensive Therapy Unit (ITU), currently staffed for 12 beds, and two in-patient wards. The hospital is under British management but staffed by a mixture of UK and US personnel with smaller contributions from other ISAF nations. The primary aim of the

Key messages

- ▶ Paediatric casualties account for around 10% of admissions to the deployed Intensive Therapy Unit at Camp Bastion.
- ▶ With appropriate training and support, it is possible for adult trained staff to look after critically injured children safely.

hospital is to provide medical care to ISAF personnel; however, under the Law of Armed Conflict, there is also a duty to provide medical care to the sick and injured civilians, including children, insofar as it is practicable to do so.¹

It is not unusual for children to be brought to deployed Field Hospitals for medical attention in times of war. Recent conflicts have resulted in a variable proportion of child casualties requiring treatment by deployed military medical services, with published data showing children accounting for between 3% and 18% of hospital admissions overall.^{2–6} Previous papers have described the overall paediatric workload at the Field Hospital in Camp Bastion,⁷ noting that around 40% of children to the hospital are admitted to the ITU at some point during their stay. Children account for around 13% of ITU admissions overall at Bastion⁸ and for up to 30% of ITU bed occupancy.⁹ This disproportionate ITU bed occupancy is because no rearward evacuation chain exists for children, whereas coalition soldiers admitted to the deployed ITU are usually evacuated within 24 h of admission.

Children pose a particular challenge as many members of the deployed multidisciplinary team have little specific paediatric training or expertise. Specialties represented in the Field Hospital include general, orthopaedic and plastic surgery, acute adult medicine, anaesthesia and intensive care. Although some deployed staff may have a special interest or sub-specialisation in paediatrics, there is no deployed paediatrician, nor are there currently any full time paediatricians employed by the Defence Medical Services.

The purpose of this paper is to review the paediatric workload in the deployed adult ITU at Camp Bastion following on from a previous report in 2009,⁹ looking in more detail at injury patterns, interventions and outcomes, and at how the unit has developed to cope with the challenge of looking after critically ill children in a resource limited environment.



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MATERIALS AND METHODS

The Bastion ITU database was cross-referenced with the Joint Theatre Trauma Registry (JTTR) to identify any patient under 16 years admitted over a 1-year period from 1 April 2011 to 1 April 2012. Data were collected prospectively on both databases. The ITU database has demographic and diagnostic data, length of ITU stay, ITU interventions, surgery, use of blood products and outcome. The JTTR contains demographic and diagnostic data, injury severity scores, ED and surgical interventions and outcome. Patients referred for advice via teleconference with Kids Intensive Care Decision Support (KIDS), the Birmingham Children's Hospital paediatric intensive care retrieval service (Birmingham, UK), were identified from the KIDS database. Statistical analysis was with SPSS (IBM, USA).

Ethics

The study was registered as an audit with the Royal Centre for Defence Medicine (RCDM/Res/Audit/1036/12/0303), which reviewed the study and waived the need for formal ethical approval.

RESULTS

Demographics, diagnosis, interventions and outcome

In the 1-year period there were 811 ITU admissions, of which 112 (14%) were paediatric cases (defined as any patient under 16 years of age); 97/112 were acute admissions and 15 were readmissions of children either discharged to the ward or readmitted from other ISAF hospitals after specialist consultations. The median age was 8 years (IQR 6–12, range 1–16).

Of the 97 acute admissions, three had medical problems, one was admitted after elective surgery and the remainder were trauma (80 cases) or burns (13 cases) patients (Table 1); 45/52 blast injuries were due to improvised explosive devices and indirect fire such as mortar fire in seven.

Thirteen cases were burns, mostly sustained in domestic incidents, and these children were significantly younger than those presenting with other mechanisms of injury, reflecting the known epidemiology of burns in the third world.¹⁰ Burns patients also had a tendency toward higher mortality (Table 1).

The body areas affected in the 80 trauma cases were head in 21/80 (26%), face or eyes in 28/80 (35%), thorax in 9/80

(11%), abdomen in 16/80 (20%), pelvis or genitals in 3/80 (4%) and extremities in 36/80 (45%). Four body areas affected were in 2/80 (3%) cases, three in 5/80 (6%), two in 28/80 (35%) and one in 45/80 (56%). Body area affected varied according to mechanism of injury, with gun shot wound (GSW) associated with thoracic and abdominal injury, blast with extremity and facial injuries and blunt mechanism with head injury (Figure 1). Blast injury affected significantly more body areas (median=2) than GSW or blunt injury (median=1, Kruskal–Wallis $p=0.003$).

Median length of stay was 0.92 days (IQR 0.45–2.65); 82/112 admissions (73%) were mechanically ventilated and 16/112 (14%) required inotropic support. The length of stay and ventilator days were similar across the different mechanisms of injury (Table 1)—12/112 (11%) died before unit discharge. Paediatric transfusion requirements were significant, with seven patients requiring more than 10 units of blood products (Figure 2). Surgical specialty input included general surgery in 65 cases, orthopaedics in 37, neurosurgery in 14, plastics in 13 and maxillofacial in four. A total of 16 patients (14%) were transferred to other ISAF centres in Afghanistan for subspecialty input not available at Bastion, mainly to Kandahar Air Field hospital for neurosurgery, and for 12 of these patients, hospital mortality data are not available.

Trauma scores, including ISS, New Injury Severity Score (NISS) and predicted mortality from Trauma Injury Severity Score (TRISS), were available from the JTTR in 65 out of the 80 acute trauma cases. The ISS was significantly higher and NISS and TRISS had tendency to be higher in blast injury (Kruskal–Wallis $p=0.016$) (Table 1 and Figure 3). None of the eight children with ISS or NISS >60 are known to have survived—five died at Bastion and three were transferred out for specialist care at other ISAF centres; however, of the 16 patients with predicted mortality >50% by TRISS, seven survived.

Binary logistic regression models looking at survival in the 80 acute trauma patients (excluding patients in whom the outcome was unknown) including age, ventilation, inotropes, ITU blood product requirement and injury severity scores demonstrated that the only factor significantly associated with death were the injury severity scores (NISS, $p=0.001$, ISS, $p=0.017$, TRISS, $p=0.005$).

Table 1 Acute trauma admissions by mechanism of injury, $n=93$. NISS and TRISS are not appropriate for thermal injury

	Blast (n=52)	GSW (n=16)	Blunt (n=12)	Burn (n=13)	Statistics
Age	8 (6–12)	10 (7.5–12.5)	9 (4.75–10)	5.5 (3–7.75)	$p=0.034$ (KW)
ISS	22 (16–32)	16 (9–17)	10 (9–13)	NA	$p=0.016$ (KW)
NISS	30 (17–45)	21 (13–30)	15 (11–23)	NA	NS (KW)
TRISS	19.2 (1.9–63)	2.2 (1–21.2)	6.9 (0.7–22.6)	NA	NS (KW)
Known deaths	5/52 (9.6%)	2/16 (12.5%)	1/12 (8.3%)	4/13 (30.7%)	NS (χ^2)
Body areas affected	2 (1–2)	1 (1–1)	1 (1–1)	NK	$p<0.001$ (KW)
Length of stay	1.1 (0.3–2.6)	0.8 (0.5–2.8)	0.6 (0.3–2)	0.6 (2.4–0.5)	NS (KW)
Ventilator days	1 (1–2)	1.5 (0.8–2.3)	1 (0–2.3)	1 (0–2)	NS (KW)

Bold indicates statistical significance.

Medians and IQRs are given.

ISS, Injury Severity Score; NISS, New Injury Severity Score; NK, not known; KW, Kruskal Wallis test; TRISS, Trauma Injury Severity Score.

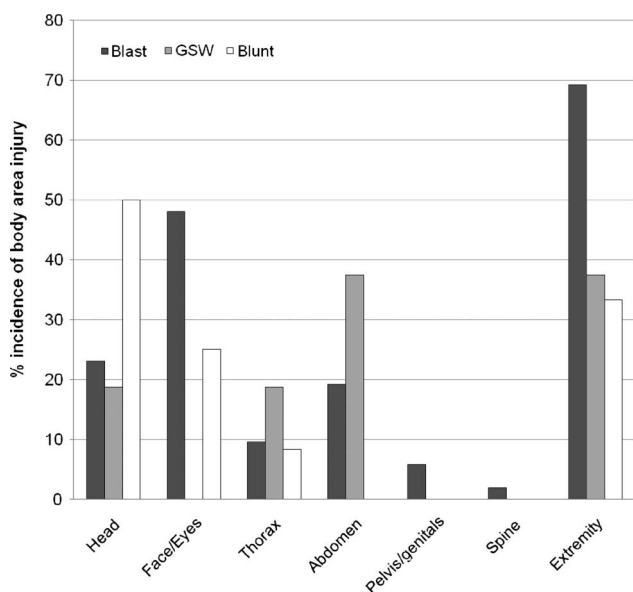


Figure 1 Incidence of body area injury according to mechanism of injury.

Cases requiring specialist advice from the UK

During the year, seven children were discussed with KIDS for specialist advice. Reasons for the call included: confirmation of present management (two cases); ethical dilemmas relating to limitation or withdrawal of life-sustaining therapy (one case); management of renal failure (one case); management of head injury (one case); subglottic stenosis (one case); and management of opiate overdose (one case). In all cases, the call advice was given by a consultant paediatric intensivist; in two cases, a further paediatric specialist from Birmingham Children's Hospital also entered the conference call. In all cases, the advice

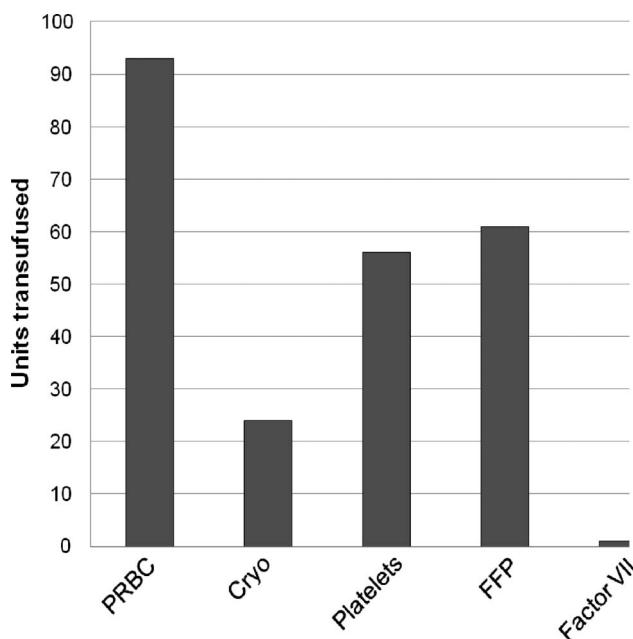


Figure 2 Utilisation of blood products (excludes products administered in Emergency Department and in Theatres). PRBC, packed red blood cells; cryo, cryoprecipitate; FFP, fresh frozen plasma; Factor VII, recombinant Factor VII.

received from KIDS supported local management and was consistent with the limitations of deployed medical care.

DISCUSSION

The situation in the hospital in Camp Bastion, in which children are admitted to an adult ITU, contrasts to the UK, where after two decades of centralisation, Paediatric Intensive Care Unit (PICU) services are located in a small number of regional centres.¹¹ Critically ill children presenting at UK centres without a PICU are usually transferred to a PICU by well resourced retrieval teams.¹² As this centralisation has been associated with lower mortality,^{13 14} it may be tempting for staff used to working in a developed world setting to conclude that the deployed ITU should not treat children. However, under the Law of Armed Conflict, including the Geneva Conventions, there is a duty imposed on parties involved in conflicts to provide medical care to sick and injured civilians, insofar as it is practicable to do so. This includes children.

Consequently, a number of strategies have been developed over the course of the Afghan conflict to improve paediatric care in the Field Hospital at Camp Bastion. One example of this is the development of the Paediatric Anaesthesia and Critical Care Special Interest Group (PACCSIG), a group of military critical care providers and anaesthetists with an interest in acute paediatrics, paediatric anaesthesia and paediatric critical care. PACCSIG was commissioned by the Defence Consultant Advisor in Anaesthetics and provides clinical guidelines, advice and recommendations on equipment and training.^{8 15-17}

Furthermore, paediatric training is now provided for all staff during the pre-deployment training phase. Paediatric simulation scenarios are included in an intensive 2-week practical phase of training in the replica of the Field Hospital at the Army Medical Services Training Centre in the UK. This training, along with advanced life-support training, is compulsory for all hospital based staff. Paediatric modules and scenarios are included in the Military Operational Surgical Training course, a weeklong course attended by consultants in surgery, anaesthesia and critical care. Many medical and nursing staff also arrange short placements on PICUs to familiarise themselves with aspects of management which differ in children.

A full range of paediatric airway and vascular access equipment is available in the hospital. Recently, the ITU has acquired Vela ventilators, which have the capacity to provide ventilation of children down to 5 kg. The Children's British National Formulary and a PICU drug calculator are available in the deployed ITU and specific drug infusion charts for children have recently been developed. Paediatric guidelines are available in the Clinical Guidelines for Operations, published by the UK Defence Medical Services, along with a variety of PICU clinical guidelines from UK centres. Military specific PICU guidelines are currently in development by PACCSIG. Specialist advice is available by telephone from KIDS, the Birmingham Children's Hospital paediatric intensive care retrieval service (Birmingham, UK). Clinical governance is devolved to the deployed Field Hospital, where there is a system of incident reporting and investigation similar to that seen in the UK.

Ethical dilemmas arise when children present with very severe injuries that may radically limit quality of life, or injuries known to have a poor outcome in the deployed environment.¹⁰ These include penetrating head trauma, severe burns or multiple injuries. Early adoption of a palliative approach may explain the tendency toward higher mortality (with short length of stay) seen in the burns patients in our series. Renal failure may also be a scenario in which palliative care is considered if recovery is not anticipated, as

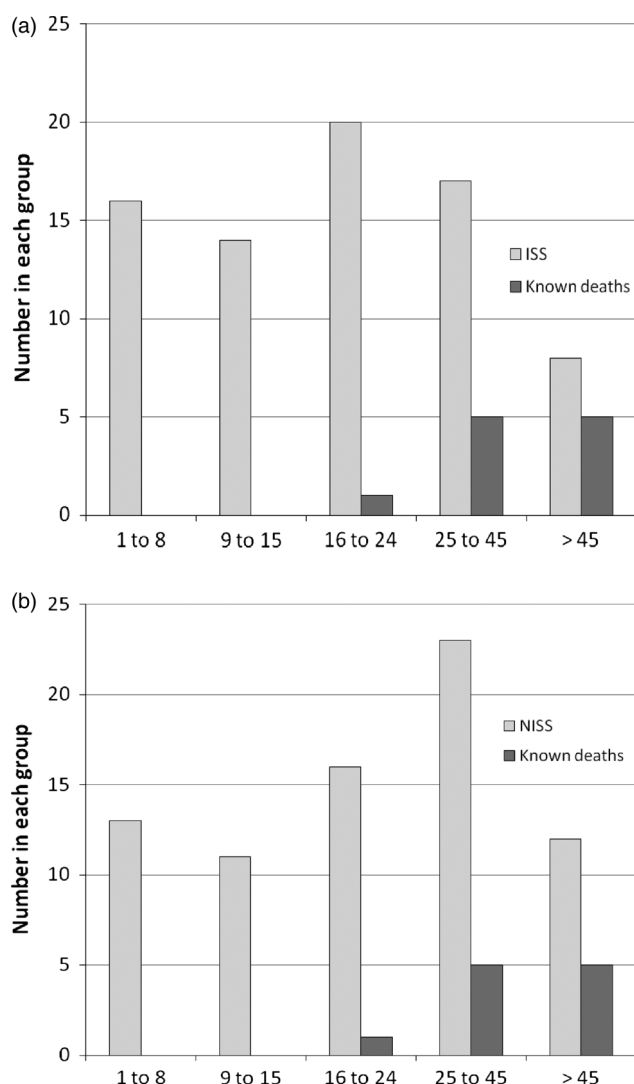


Figure 3 (A and B) Distribution of Injury Severity Scores (ISS) and New Injury Severity Scores (NISS), along with known deaths.

renal replacement therapy is not available in the deployed ITU at Bastion. While staff always try to act in the best interests of the child, sometimes these interests are difficult to assess.

Resource allocation is an immediate problem in the deployed ITU, unlike in the UK, where non-availability of critical care beds in one unit usually results in transfer of patients to other units. This possibility is not available in the deployed ITU. While the ITU has not as yet reached full capacity with local nationals, paediatric admissions could potentially create a capacity pressure. If capacity was ever exceeded this would be mitigated by discharge of patients clinically stable enough to transfer out, then allocation of resources to those most likely to benefit from treatment.

All UK based hospital medical and nursing personnel are required to undergo child protection training prior to deployment. However, as child protection services such as those seen in the developed world do not exist in Afghanistan, it is difficult to address any child protection issues which may be recognised.

Despite all these measures, dealing with critically unwell children can still be very stressful. To address this problem, for UK staff there are established systems for psychological and psychiatric support through Field Mental Health Teams on deployment and through Defence Medical Services in the UK. For UK

staff, a 36 h decompression in Cyprus is also compulsory before returning home. Senior hospital staff are aware of the emotional impact of caring for critically injured, ill and dying children and staff informally debrief each other regularly.

The willingness with which deployed military ITU staff treat children is sometimes in contrast to civilian hospitals in the developed world, where many staff trained in adult specialties feel deskilled and may be reluctant to treat children, even in emergencies.^{18–19} Our results suggest that with appropriate training and support and within a properly organised trauma system, it is possible for adult trained staff to look after critically injured children safely.

The scores, ISS, NISS and TRISS, which have been validated for paediatric use in civilian studies,^{20–21} were available from the JTTR for 65/80 of the trauma patients. The pattern of injuries seen, the epidemiology, the proportion of high injury severity scores (with >50% patients having ISS >15) and outcomes are similar to those documented in other recent case series from Iraq and Afghanistan.^{5–6,22} In our study, 8 (12%) children had ISS or NISS >60, none of whom survived—these deaths are all expected. However, of the 16 patients with predicted mortality >50% by TRISS, seven survived. Such patients have previously been characterised as ‘unexpected survivors’,²³ although clearly some might be expected to survive. There was only a single documented death in a patient with TRISS <50% and no documented deaths in patients with ISS or NISS <16 (Figure 3). Binary logistic regression showed that the severity of the initial injuries was the only factor associated with death. Death was not associated with ITU interventions. Taken together, these data suggest that overall ITU performance, at least in terms of mortality, is good at Bastion.

Limitations

The overall ITU mortality at 11% is almost certainly an underestimate as it excludes deaths in transfers out to other ISAF centres, for which details were not available. Unfortunately, standardised mortality using a PICU severity of illness score such as Paediatric Index of Mortality Score 2 (PIM2) was not available, though PIM2 data are now being collected prospectively in Bastion. Although injury severity scores may provide some indication of expected mortality, these scores are not validated for patients surviving to ITU admission and were not available in all patients. Unfortunately, other markers of quality of care, including in-unit and post-discharge morbidity, were not available.

CONCLUSIONS

Previous studies of deployed military paediatric care have looked at the epidemiology of much larger numbers of children presenting to the ED. This is the first study to look in detail at the population of children admitted to ITU and to describe how the deployed adult ITU has developed strategies to deal with the challenge of looking after children. The aspiration to provide the best possible care despite the limitations is clear. This ethos along with the measures described results in adult intensive care staff delivering this care to children presenting with injuries of a severity almost never seen in the developed world. Difficult decisions regarding ongoing care will continue to be made, with staff doing their best to act in the best interests of the child, in accordance with international and military law and relevant professional guidelines.

Correction notice This article has been corrected since it was published Online First. The title of the article has been amended.

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