

Critical care where there is no ICU: Basic management of critically ill patients in a low-income country

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INTRODUCTION

Critical care can be defined as all care given in hospital to patients with serious and reversible disease. The burden of critical illness is especially high in developing countries.¹ Over 90% of maternal deaths, child deaths, deaths from sepsis and deaths from trauma occur in developing countries.² 50% of child deaths in hospitals occur within 24 hours of arriving at the hospital. One survey from South Africa found that as many as one in four of medical admissions is critically ill.³

High-income countries can afford resource-intensive and sophisticated services for managing critical illness. In countries with much lower healthcare spending, there is a need for inexpensive critical care, but there are many barriers to its provision. Processes for prioritising and caring for critically unwell patients are not routinely implemented. Life saving drugs and equipment are not immediately available. Medical guidelines often lack relevance and treatments may not be evidence-based for resource-poor settings. Staff training in the management of critical illness is uncommon, and intensive care units (ICUs) are rare. Critical care has not been promoted as it cuts across traditional disciplines and lacks advocates.

Critical care need not be expensive. Cheap treatments such as adequate fluid resuscitation to children with diarrhoea and intravenous dextrose for hypoglycaemia can be life saving. Emergency triage and treatment for children in a hospital in Malawi costs only US\$1.75 per patient and has reduced hospital mortality by 50%.⁴ Oxygen therapy can cost between one and six US dollars per day (WHO figures).

In this article we describe critical care services which are feasible in a district hospital in a low-income country. We focus on the hospital structure, routines and basic clinical management and do not discuss advanced interventions such as mechanical ventilation and dialysis, or care within specialist intensive care units.

THE HOSPITAL STRUCTURE

Critically ill patients arriving at hospital require early identification and treatment. An appropriate physical environment can facilitate this. Formal triage systems at the entrance to hospital should divide the patients

into urgent and routine cases, and direct the urgent cases to a resuscitation room or emergency department. Dividing the patients in this way can be both clinically and cost effective, as resources can be focused on those who have the most pressing clinical needs.

The emergency department should be adjacent to the hospital entrance and have facilities designed for managing emergency patients. There should be resuscitation bays or rooms for immediate treatments, with emergency drugs and equipment always at hand. Medical staff should be present or on-call 24 hours-a-day and have senior staff who can be called quickly for complicated or serious cases. Treatment rooms should be spacious to allow a team of several health professionals to work efficiently together and communication between practitioners must be prioritised; a quiet place with good access to radiology, laboratory and surgical provision is ideal.

Within the hospital, at least 1-2% of beds should be assigned for the critically ill.⁵ This means at least 4-8 beds in a 400-bed hospital. An ICU can concentrate expertise and resources and provide good critical care. Staff can receive directed training in managing the critically ill, effective routines can be set up and emergency drugs and equipment can be kept near the patients who need them most. However, there is a risk that an ICU could divert already scarce resources from the rest of the hospital: it should provide treatments and facilities consistent with the rest of the healthcare system. Where a separate ICU is not possible, designating beds on a general ward as 'critical care' or 'high dependency' beds improves medical oversight.

Where resources allow, hospitals can introduce a 'Rapid Response Team'. This is a team of hospital staff trained in critical care who may be summoned to support the care of seriously ill patients on a general ward. Rapid Response Teams can improve communication between the wards and the ICU. They can provide critical care treatments outside the designated ICU and provide 'on the job' critical care training to general staff.

IDENTIFYING THE RIGHT PATIENTS

Triage is the quick and accurate detection of patients with life threatening illness. Formal triage systems are

Summary

Many of the life saving therapies delivered in an ICU can be delivered in the most resource-poor settings. This article describes how infrastructure, personnel and clinical care may be designed to deliver effective care for all critically ill patients.

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ubiquitous in hospitals in many parts of the world, but in low-income countries triage is often absent or of poor quality. Queue-based systems are common and can result in delays for the critically ill patients and less rational prioritisation of the hospital's resources.

Every hospital should have a formal triage system for new patients. Triage should precede registration processes and payment for services. The triage area should be close to the hospital entrance and be near to (or part of) the emergency department. As triage has the potential to save lives and reduce costs, it should be a prioritised activity, with senior staff appointed where possible.

Triage must be quick and simple. The choice of triage system depends on the available human and physical resources. Most triage systems involve vital signs, early warning scores or danger signs.

Vital signs

Abnormal vital signs (heart rate, respiratory rate, systolic blood pressure, conscious level, body temperature, oxygen saturation) have been shown to predict mortality in a low-income setting. Limits or 'triggers' can be defined for each vital sign and any patient with one or more observations falling beyond these triggers is categorised as critically ill (see Table 2 in previous article).

Early warning scores

Combining several vital signs may improve the accuracy of triage decisions. Compound scores or 'Early warning scores' encompass multiple physiological measurements, each of which may be graded according to the degree of derangement.⁶ An aggregated score summarises all of this data into a single number. With increasing score the risk of mortality rises. A threshold can be chosen above which the patient is labelled as critically ill or an action is taken.

Danger signs

Danger signs are physiological findings or conditions that indicate that the patient is critically ill. The danger signs form a checklist that is simple to follow, standardises the triage and allows for the coupling of triage to early life saving interventions. A patient with any danger sign (for example 'reduced conscious level') is classified as an emergency, and the checklist indicates which investigations or treatments should be initiated.

Ward-based triage

Further identification of critical illness also takes place after admission to hospital. Such ward-based triage involves the regular assessment of clinical status in order to detect the deteriorating inpatient. Vital signs should be checked regularly and the triggers used for defining critical illness. The intuition of the ward nurse is a valid additional criterion.

Postoperative critical care

Postoperative patients can leave theatre in a critical state, due to the effects of the surgery and anaesthesia. Many of these patients have a good prognosis if they receive adequate critical care for a limited period of time. Indeed, many ICUs have begun as postoperative units. Hospitals with ICUs should have the capacity to manage the critically ill postoperative patient. Hospitals without an ICU should have a recovery room, where the patients can be cared for directly after the

operation, and critical care or observation beds on the general ward.

An initiative for predicting postoperative risk, the Surgical Apgar Score, has recently been developed.⁷ Based on three intra-operative parameters: estimated blood loss, lowest heart rate and lowest mean arterial pressure, it has been shown to provide an objective indication of risk and could be used for post-operative triage in hospitals in low-income countries (see Appendix 1).

Criteria for admission to ICU

An ICU should have well defined admission criteria. These criteria depend on the facilities and expertise available but should be based on the hospital's triage systems. The goal is to admit the patients to the ICU who could most benefit from the critical care, i.e. those who have life threatening conditions and have a reasonable chance of recovery. Equally important are discharge criteria. Those patients who have sufficiently improved and no longer require critical care, or those who are judged to be too severely ill to benefit from the available care should be discharged from the ICU to free up beds for other critically ill patients.

SIMPLE ROUTINES

Although hard evidence of effective critical care interventions is lacking, it is clear that earlier treatment, more intensive monitoring and more goal-based systems have been beneficial. Increasing staff to patient ratios improves all of these and may be the single most important factor for successful critical care. Regular physiological observations can identify deterioration early and monitor the success of interventions. Frequent assessment by medical staff is similarly important – twice daily ward-rounds of critically unwell patients and 24 hour access to a clinician should be routine.

The most effective interventions for the critically unwell patient are simple, but need to be carried out quickly. Emergency drugs and equipment such as diazepam, oropharyngeal airways, oxygen delivery equipment, intravenous fluids and giving sets should be kept on the ward and always be available. A full list of emergency drugs and equipment is in Appendix 2. Keeping these well stocked is challenging: supplies may be erratic, used items may not be replaced and equipment may be 'borrowed' for use elsewhere. For an efficient emergency service, these disruptions must be minimised. A list should be kept on the ward and daily stock-taking and equipment testing by designated 'in charge' clinical staff should be carried out. Critically ill patients should not be required to pay before they have access to life-saving therapies and relatives and staff should not need to leave the ward to find or purchase the treatments.

The patient's observations, received treatments and fluid balances should be regularly documented. This enables early recognition of the deteriorating patient, monitors the success of the care and reduces errors in drugs prescription and dispensing. Documentation can also be useful for quality control and audit. Basic hygiene routines including hand washing before and after patient contact and use of disposable gloves should be rigorously followed to reduce nosocomial infections.

CLINICAL MANAGEMENT

Effective clinical management of the critically ill patient involves concentrating on the common and easily preventable causes of

mortality. These are often described with the 'ABCDE' acronym. The clinician should begin by assessing the Airway, treat any abnormality found, then successively assess and treat the Breathing, Circulation and Disability (neurological dysfunction) before moving on to Everything Else. This approach is used in emergency and critical care training all over the world and has been found to be effective and easy to remember, even in stressful circumstances. The details of clinical management are covered in detail in several other articles in this edition of *Update*.

IMPROVING QUALITY OF CARE

Staff should be adequately trained in caring for critically ill patients. Training includes both 'pre-service' in colleges and universities, and 'in-service' through courses and seminars. Evaluation and feedback from external senior critical care specialists can be valuable. National and local guidelines and standards for managing the critically ill are rare and should be developed to encourage improved care.

All hospitals should have a system of audit for evaluating the care they are providing. Additionally, specific case discussion as part of mortality and morbidity meetings (M and M) is useful. This evaluates the strengths and weaknesses in the medical care of fatal cases. It is fundamental to their success that blame attribution is not pursued, but sensitive discussions may identify specific areas for improvement.

ETHICAL ISSUES

Critical care brings with it several specific ethical issues. These issues are extremely important and health staff should have an understanding of them. Critically ill patients and their relatives should be treated sensitively and with respect. Decisions are frequently made that have a huge impact on the patients' lives and sometimes the patient is incompetent to make decisions themselves due to their illness.

End-of-life care has great social, cultural and religious, as well as medical, importance. Continued active treatment of a patient, who will not benefit from it, should be avoided. Palliative care services and adequate pain-relief can improve support for patients and their carers at the end of life. The point at which treatment becomes palliative rather than 'active' depends on the wishes of the patient, informed by senior medical opinion and may often be affected by cultural norms.

CONCLUSION

The requirements for a simple critical care service are summarised in Table 4. In order to ensure such services are routinely available, critical care needs to be moved up the policy agenda. Strong advocacy is required, even if hampered by the lack of critical care specialists. Training in critical care is crucial and should be aimed at both newly trained and professionally established healthcare workers. While there remain so few critical care physicians, other clinicians must be trained in providing effective care to critically unwell patients. Increasingly, hospitals in less developed settings are developing links with those from high-income countries.

This has the potential to improve training, and act as a catalyst for improvement in care. However, care should be taken that such initiatives are truly collaborative and well grounded within the existing hospital systems. Research is required to give a better understanding of critical care in low-income settings, to evaluate the clinical effectiveness of critical care interventions and to establish their cost effectiveness. The WHO recently began promoting surgical services as a way to reduce mortality and morbidity. Critical care should be next in line.

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Table 1. Requirements for a simple critical care service.

Hospital structure	Emergency department ICU or critical care beds on a ward
Identifying the right patients	Triage on admission Triage on wards
Routines for Critical Care	Increased nurse:patient ratio Regular observations Regular ward rounds Senior medical review Emergency drugs and equipment to hand, restocked, no need to pay Documentation
Clinical management	ABCDE approach Supportive care
Improving the quality of care	Training and supervision Guidelines Audit and clinical governance

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APPENDIX 1. *The 10-point Surgical Apgar Score⁷*

	0 point	1 point	2 points	3 points	4 points
Estimated blood loss (ml)	>1000	601-1000	101-600	≤100	
Lowest mean arterial pressure (mmHg)	<40	40-54	55-69	≥70	
Lowest heart rate (beats per min)	≥85*	76-85	66-75	56-65	≤55*

*Occurrence of pathologic bradyarrhythmia, including sinus arrest, atrioventricular block or dissociation, junctional or ventricular escape rhythms, and asystole also receive 0 points for lowest heart rate. The Surgical Apgar Score is calculated at the end of any operation, from the estimated blood loss, lowest mean arterial pressure and lowest heart rate entered in the anaesthesia record during the operation. The score is the sum of the points from each category.

APPENDIX 2. *Emergency equipment and drugs for use in Critical Care. This is a generic list and should be modified according to local and national resources, pathologies and formularies. Modified from: WHO Essential Trauma Care Guidelines; WHO Generic Essential Emergency Equipment List; Baker et al "Standards for Good Quality Emergency and Critical Care in Low Income Countries" (unpublished).*

Equipment

Clock with second hand
Gloves - clean
Gloves - sterile
Sharps disposal
Running water
Soap
Oropharyngeal airway (adult and paediatric sizes)
Suction machine (foot powered or electric)
Suction catheters - size 16FG
Laryngoscope (working and spare batteries)
Endotracheal tubes – adult and paediatric sizes
Rigid neck collar
Sandbags/towel rolls and head restraints
Chest tube & underwater seal (or equivalent)
Sterilised surgical set for small procedures
Oxygen concentrator/cylinder with face masks or nasal prongs and tubing
Pulse oximeter
Resuscitator bag and mask (Ambu bag)
Stethoscope
Foetal stethoscope
Blood pressure monitoring equipment
IV cannulae – adult size (e.g. 18G)
IV cannulae – paediatric size (e.g. 22G, 24G)
IV giving sets
Needles
Syringes – at least 2ml, 5ml
Lumbar puncture needles
Urine catheters & bags
Gauze and bandages
Skin disinfectant
Torch (and spare batteries)
Electricity 24hours/day
Telephone or other emergency communication system
Light suitable for clinical examination
Bedside blood glucose testing device and strips
Thermometer
Refrigerator
Weighing scales – adult and paediatric
Nasogastric tubes
Spacer device for inhaled salbutamol

Drugs

Oral rehydration solution
IV glucose 5%
IV glucose 50% (or other concentration $\geq 10\%$)
IV crystalloid (Normal saline or Ringers lactate)
Diazepam
Paracetamol
Parenteral penicillin (or equivalent)
Parenteral gentamycin (or equivalent)
Parenteral quinine (or equivalent)
Ketamine
Lignocaine for local anaesthesia
Epinephrine (adrenaline)
Atropine
Frusemide
Nifedipine or other anti-hypertensive
Aminophylline
Salbutamol (for inhaler or nebuliser)
Hydrocortisone
Insulin
IV/IM opioids e.g. morphine
Naloxone
Thiopentone
Succinylcholine
Non-depolarising muscle relaxant
Oxytocin/ergotamine
Magnesium sulphate
Phenobarbital/phenytoin