

Intensive care medicine in rural sub-Saharan Africa - who to admit?

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INTRODUCTION

St.Mary's Hospital Lacor is a not-for-profit, church hospital situated in northern Uganda. It is in a rural area which, until recently, has suffered considerable insecurity and is in one of the poorest areas of rural sub-Saharan Africa.¹ The hospital has significant overseas support and patient care is subsidised in order to fulfil its mission of serving the poorest patients to the highest standards possible. There are approximately 500 hospital beds and 5000 operations are performed in the theatre block per year. Since July 2005 we have prospectively collected data on outcomes of all patients admitted to the ICU. The data of over 2000 patients is stored on an Access® database.

ICU STAFFING AND INFRASTRUCTURE

The eight-bed ICU has 8 trained nurses and 4 assistant nurses. There is one anaesthetic officer assigned to the ICU who also covers the emergency theatres in the night, with one nurse anaesthetist. One overseas anaesthesiologist, has been attached to the ICU for the last 9 years and he is the only physician with a clinical responsibility totally to the ICU. All patients are admitted under the care of the admitting physicians,

who also have duties in the main wards, labour ward, outpatients and theatre. There are no other dedicated ICU medical staff.

The majority of the nurses on the ICU are not rotated around the main wards, as is often the custom in other institutions, so that a core of locally trained specialised ICU nurses has been retained.

The ICU has no capacity for peritoneal dialysis or haemodialysis. There are no infusion pumps or blood gas analysis and it is only occasionally possible to estimate serum electrolytes. There are currently three Glostavent ventilators (Diamedica, UK) in ICU with a fourth in theatre and an adequate number of pulse oximeters and non-invasive blood pressure machines. The ratio of trained nurses to patients varies from 1 to 4 to 1 to 8. The ICU is a large open-planned area with two cubicle spaces, situated close to theatre (Figure 1).² With a physical capacity of eight beds, and with the added possibility of admitting more patients on trolleys if required, the ICU is rarely physically short of beds to accept referrals from the hospital clinicians. However the nursing staff number is fixed so in busy times the ratio of nurses to patients suffers.

Summary

This article describes some of the factors to be weighed up when considering which patients are appropriate for admission to an intensive care unit in a country with limited resources. The authors describe their experience running an ICU in a rural part of Uganda, and use the audited outcomes of a cohort of 2,202 patients admitted over a six-year period.

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Figure 1. The intensive care unit at St Mary's Hospital Lacor, Uganda.

ADMISSIONS POLICY

Admission of patients to the ICU is open to any clinician, with no strict policy to guide this. Clinicians have discovered by a process of clinical experience how best the ICU could serve their patients and inappropriate admissions have been identified by ward round feedback on a daily basis.

The difficulty of deciding who to admit to the ICU has both ethical and clinical factors. The concept of futility remains an issue no matter what resources are available and it remains an issue of continuous discussion in many guises. If ICU admission is refused then the patient will receive the level of care that is offered on the general wards, and so this must also be evaluated in order to compare that offered in the ICU.

General ward care

The patient ratio on the wards may range from one trained nurse to 30 patients to one trained nurse to 60 patients, with the night shifts often the most stretched. Any critically ill and unstable patient who is denied access to the ICU will then be admitted to the ward, where both the nurse to patient ratio, and the experience of the individual nurses to deal with these patients, is far less favourable than in ICU. However, we do not have data from ward patients for direct comparison to the ICU patient population.

The issue of who to admit to the ICU and also who to discharge back to the ward is, in practice, an ongoing discussion between the ICU and ward-based clinicians. ICU ward rounds are conducted three times per day and the suitability of each patient for discharge back to the wards is discussed, in light of new referrals and the need to maintain a good nurse to patient ratio.

ANALYSIS OF ADMISSIONS TO ICU

The annual rate of admissions to ICU has grown over the last 5 years, from 264 patients in 2006 to 449 patients in 2010. The ICU mortality has remained at a steady level, ranging between 26 to 36% (Figure 2).

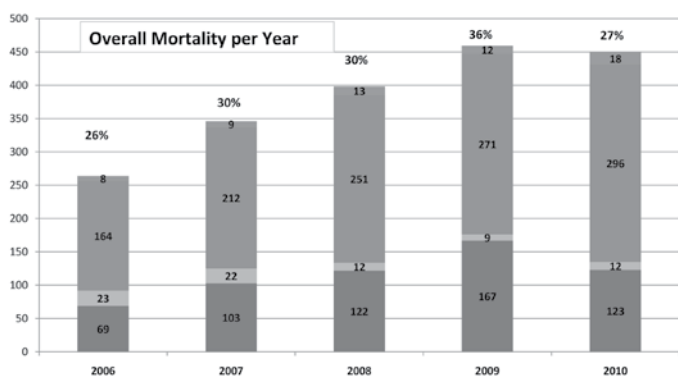


Figure 2. Analysis of admission to ICU at St Mary's Hospital Lacor, with mortality data. Upper section of bar = number referred; second section from top = number discharged to ward; third section from top = number discharged home; bottom section = number died

The work of Fenton and colleagues, assessing the mortality of Caesarean sections in Malawi, demonstrated that 80% of deaths occur in the postoperative period.³ It is likely that general surgical deaths have a similar postoperative emphasis in Africa. Figure 3 shows our outcomes in 2202 patients over the last 6 years, shown according to their admission specialty.

Thirteen arbitrary diagnostic groups were used. The development of our ICU has largely been driven by a need to meet the demands of the surgical, obstetric and gynaecological services. Medical admissions comprise 7% of admissions with a mortality of 47%. We have encouraged the development of a high dependency area within the general medical ward, containing oxygen concentrators and pulse oximeters, so that rational oxygen therapy can be administered without the need for ICU admission for this reason alone.

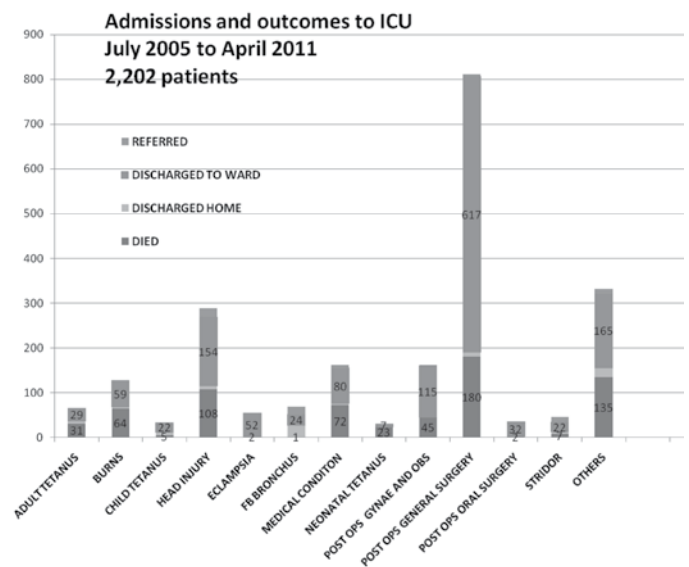


Figure 3. Outcomes in 2202 patients over the last 6 years, shown according to their admission specialty. 'Referred' means admitted to the ICU but later referred to another hospital, usually the teaching hospital in Kampala.

Head injured patients, judged clinically to be unsuitable for ward management are admitted to the ICU, but our policy has always been not to undertake advanced respiratory support, with intubation and ventilation, in these patients. The limited number of nurses and ventilators, along with the expectation of poor outcomes, even with prolonged ventilation, has ensured that this policy persists today. On rare occasions intubation and ventilation has been commenced, when sputum retention is considered to be a major factor in deteriorating coma or when early referral to an urban area is an option. Of 282 head-injured patients admitted, 108 died, 154 were discharged to the ward and 20 were referred on to Mulago Hospital, Kampala for further care. Overall mortality for head injured patients admitted to ICU was 37%.

All patients undergoing thyroidectomy are admitted to the ICU postoperatively for at least one night, as our experience is that a small number of patients develop airway problems postoperatively on the main ward. These are not reliably recognised and effectively managed on the general ward.

Figure 3 shows that postoperative general surgical patients form the largest diagnostic group in our ICU patient population. The mortality for this group is 22%, perhaps reflecting that our non-physician anaesthetists recognise the importance of adequate preoperative resuscitation. During the intraoperative period active resuscitation, cardiorespiratory monitoring and respiratory support is continuous.

We now view the postoperative period as the time of greatest risk to the patients - the general wards have a poor nurse to patient ratio, limited monitoring and limited senior staff available ward, meaning that monitoring of hypoxia and adequate blood and fluid replacement is difficult to establish. The non-physician anaesthetist assigned to the ICU is ideally situated, equipped and trained to identify high-risk postoperative patients needing blood, fluid and/or oxygen therapy, as well as pain relief.

Ventilation in ICU

Among the general surgical patients, 181 (23%) were also given intermittent positive pressure ventilation (IPPV) and the overall mortality of this sub-group was 52% (Figure 4).

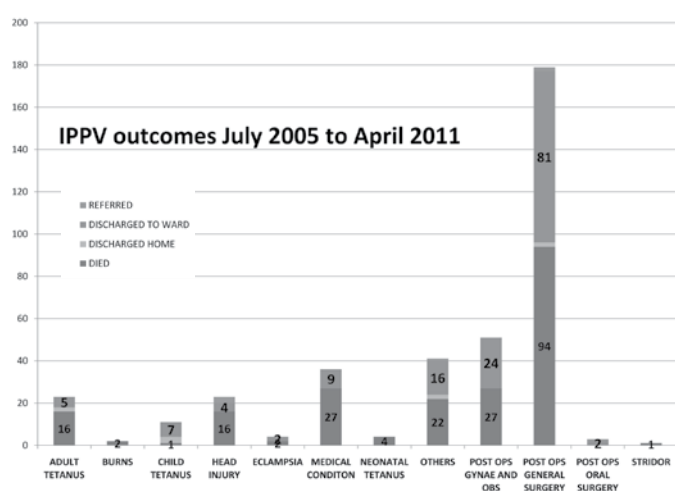


Figure 4. Outcomes of ventilated patients by diagnostic group.

Postoperative IPPV is the main invasive ICU intervention that we can offer. Our theatre anaesthetist is trained to identify patients with cardiorespiratory instability during surgery or in the immediate postoperative period, that may benefit from postoperative IPPV. These patients are transferred to ICU for ventilation. We use the same type of ventilator/anaesthesia machine (the Glostavent) in theatre and in ICU, and this has made this process of postoperative IPPV much easier to manage and teach.

Among the postoperative surgical patients who received IPPV, 83 (47%) survived. It is our view that the majority would have died if managed on the general ward without the facility for IPPV. A similar experience of postoperative support is seen with the 162 obstetric and gynaecological patients, in whom the overall mortality was 26%. Within this group 51 patients were given IPPV with a mortality of 53%, with 24 survivors. Again we believe that the majority would have died if they had received only ward care.

Figure 5 shows that in the 378 patients from all diagnostic groups, who received IPPV, the mortality was 56%, with 150 survivors. Eight patients suffered snakebite with a neurotoxic venom, where muscle fasciculation and respiratory distress required IPPV. Six of these patients were among the survivors. Six patients were admitted with some form of poisoning, often a pesticide (organophosphate) compound with five, all of whom received IPPV, surviving. Although

they represent a small subgroup, patients suffering respiratory failure following snakebite and poisoning have a good outcome in our practice. Similarly, patients who developed acute pulmonary oedema occurring under general anaesthesia formed a small group with very good outcomes when treated with postoperatively ventilation. The majority of these patients had longstanding anaemia exacerbated by acute haemorrhage, predisposing to development of pulmonary oedema.

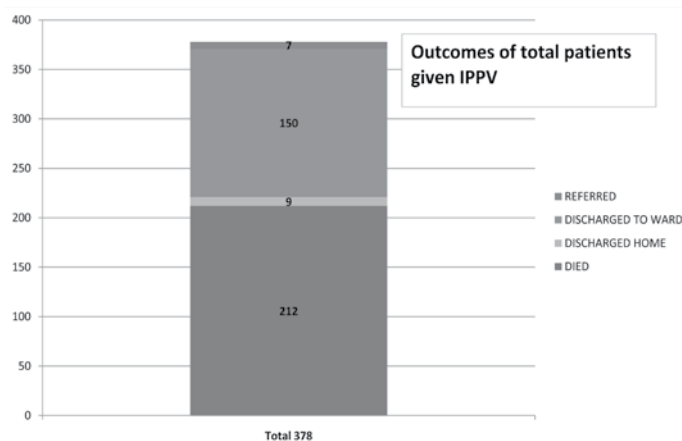


Figure 5. Outcomes of all ICU patients treated with IPPV.

Tetanus

Tetanus is a disease category which requires special consideration as its treatment lends itself particularly to the skills of anaesthetists and intensivists. We have classified tetanus into neonatal, child and adult. In our experience neonatal tetanus outcomes have been very poor, with a mortality of 77% in 30 neonates admitted. Four patients were given IPPV and all died. We no longer offer IPPV for neonatal tetanus.

The introduction of magnesium sulphate therapy for adult and child tetanus has, in our view, contributed to a major improvement in our outcomes, in comparison with the care previously offered in the general ward. Our protocols have been published in a previous edition of *Update in Anaesthesia*⁴ and follow the advice of anaesthetists in Sri Lanka.⁵ The mortality in 65 adults with tetanus receiving ICU management was 48% and in local conditions we consider this a remarkably good outcome, giving 34 survivors. In 23 of these patients tetanus was so severe that, despite large doses of magnesium sulphate, the spasms could not be controlled and so they were sedated, paralysed, ventilated and subsequently tracheostomy performed. There were 7 survivors in this group (mortality 80%).

In our experience tetanus in children has a much better prognosis with an overall mortality of 15% from 33 children. In 11 children the spasms were so severe that they were sedated, paralysed, ventilated and received tracheostomy, yet only one of these children died (mortality 9%). The management of severe tetanus in children and adults is very demanding on the ICU nurses and anaesthetists, as it may require IPPV for up to 4 weeks, but is one of the most rewarding conditions to treat. Venous access is a challenging problem in these long stay patients and femoral and internal jugular lines are usually required.

Severe burn patients are managed in the ICU and our mortality is 50%.

CONCLUSION

The majority of patients admitted to our ICU in rural sub-Saharan Africa were postoperative surgical patients. The nurse to patient ratio, close supervision and assessment by anaesthetists and basic 'ABC' interventions is superior to that available on the general wards. We believe that this has produced better outcomes for many diagnostic groups and consequently admissions rates have rapidly increased over that last six years, although we recognise that comparative data for patients receiving ward-based care is not available. The main sustainable and inexpensive invasive intervention offered in our ICU is postoperative IPPV. This is indicated in patients with reversible respiratory insufficiency and/or haemodynamic instability - conditions that would likely lead to death on the general wards.

The most dramatic effective intervention for medical patients was IPPV for poisoning by pesticides. General medical patients remain a very small percentage of our admissions over the 6 years of data collection. Tetanus patients had good outcomes compared with ward care and very early in our experience all tetanus patients were treated in the ICU. Snake bite patients with neurotoxic paralysis also did well with

IPPV. Rational use of oxygen with oximetry monitoring and oxygen therapy using oxygen concentrators has proved to be a sustainable inexpensive and effective treatment for hypoxia from whatever cause. We continue to train the general ward clinicians and nurses on basic principles of rational oxygen therapy so that ICU admissions for this sole reason are reduced.

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