Practice of intensive care in rural Africa: an assessment of data from Northern Uganda

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Introduction

Although Intensive Care Units, ICUs, may be said to have started in 1953 in Europe[1] the great majority of hospitals in rural sub-Saharan Africa have no such facility and in the context of working with major limitations in financial and human resources the planning of a facility in this environment requires careful consideration. Life expectancy in many parts of Africa is about 45 years and equivalent to the1840s in England and Wales. Medical care in Africa predates conditions not only before ICU care in Europe but even before the discovery of anaesthesia[2] and in rural sub-Saharan Africa where medical care is more limited than the urban areas the life expectancy figures must be even worse than those published for sub-Saharan Africa as a whole. A recent review of Intensive Care Units in less developed countries[3] noted the lack of data available upon which planning and organising such a facility in the developing world could be carried out.

Method

A collection of data was made prospectively in St.Mary's Hospital Lacor, Gulu, Uganda over a 12 month period from July 2005 to July 2006 on all patients admitted to the ICU and stored on a spreadsheet and database by the authors. Eighteen fields of data were stored for each patient.

St.Mary's Hospital Lacor is a Church supported previous missionary general hospital now integrated into the Ugandan health system in a rural area which continues to have a major insecurity conflict over the last 20 years. As a consequence there has been considerable breakdown in the primary health care structures in an area of severe deprivation. It has a bed capacity of 476 beds with 4 functioning operating theatres performing about 3,500 operations per year with specialists in medicine, surgery, paediatrics, oral surgery, obstetrics and gynaecology, anaesthesia, and radiology but no specialists in thoracic, cardiac or neurosurgery. With external support the hospital patient costs are 87% subsidised. An Intensive Care Unit was set up 10 years ago in a side-room off one of the surgical wards near the operating theatre and was upgraded to a purpose built unit during the course of the study with a bed capacity of 8 beds. There were no formally agreed criteria for admission to the unit during the study and this remains the practice now. The senior clinicians in anaesthesia, medicine, paediatrics, surgery and obstetrics could admit at any time subject to bed availability and the patient's clinician had ultimate clinical responsibility with the physician anaesthetist and the clinical officer anaesthetist providing a supportive role. Apart from tetanus where the anaesthetist was given major responsibility in clinical care there were no written protocols. During the period of study a clinical officer was appointed with clinical responsibilities for the ICU alone. The trained nursing ratio was approximately one nurse per 4 patients, and there were also several assistant nurses attached to the ICU. There was no capacity for haemodialysis or peritoneal dialysis, no infusion pumps and no capacity for sustained inotropic support. There was capacity for IPPV of one and sometimes 2 patients for adults or children at any one time. Two pulse oximeters and 2 oxygen concentrators were available and oxygen cylinders were available but not for long periods as the logistics of replacing empty cylinders from the nearest main city involved a five hour road journey which was limited by other demands on hospital transport. Single lumen catheter central lines were available most of the time from donations. Crystalloid intravenous fluids were available at all times and occasionally a small quantity of colloid. Pethidine, diclofenac ampicillin, gentamicin, metronidazole, chloramphenicol were available at all times and with a senior clinician's approval a small quantity of a third generation cephalosporin. Haemoglobin and blood glucose estimations were available at all times but serum electrolytes were rarely available and blood gases were never available.

As there was facility for oxygen therapy both in the paediatric ward and in the medical ward using oxygen concentrators transfer to the ICU for oxygen therapy alone from these wards was therefore not required. These main wards usually had a functioning pulse oximeter so that rational use of oxygen could be carried out on the main wards.

Results

Two hundred a eighteen patients were admitted during the 12 month period of which 47% were female and 53% male. The overall mortality was 27%. The mortality for female patients was 23% and for male was 30%. (Table1.)

Table 1: Gender distribution and mortality

	Number of patients	Died	Percentage mortality
Male	115 (53%)	35	30
Female	103 (47%)	24	23
Total	218	59	27

The age distribution and mortality of the ICU patients is shown in Table 2. As expected the extremes of life have the highest mortality and demographic distribution reflects the large percentage of younger patients in a developing country.

The patients were classified into 14 diagnostic groups and the mortality of each group is shown in Table 3. The commonest diagnostic group for admission was for general surgical post operative stabilisation which comprised 33% of all admissions. When patients in the categories of burns, obstetrics and gynaecology, oral surgery, foreign body in bronchus, and head injury are grouped together then this would make 83% of all admissions. Medical patient admissions were very few, five patients during the time of the study, and the mortality was 40%.

Table 2: Age distribution and mortality

	Number of patients	Number died	Percentage
Neonate	27	14	52
One month to 5yrs	35	7	20
5yrs to 18	31	0	0
18yrs to 60	115	33	29
Over 60 years	10	5	50
Total	218	59	27

Table 3 Diagnosis and mortality

Diagnosis	Number patients	Number died	% Mortality
Post-op stabilisation General Surgery	72	16	22
Stridor	10	1	10
Closed head injury	15	4	27
Open head Injury	10	4	40
Post-op stabilisation Obstetrics Gynae	17	6	35
Eclampsia	9	0	0
Adult tetanus	11	8	73
Child tetanus	6	0	0
Neonatal tetanus	6	5	83
Post-op oral surgery	8	0	0
Burns	14	6	43
Foreign body bronchus	13	0	0
Medical condition	5	2	40
Others	22	7	32
Total	218	59	27

Tetanus remains a major challenge in all areas of rural Africa with a total of 23 patients admitted with an overall mortality of 57%. We think that the use of magnesium has improved the mortality from previous years.[4] We have classified tetanus into 3 age groups, neonatal, child and adult. During the time of the study we had no capacity to ventilate neonates as this is a particularly demanding on the skills and time of both nurses and clinicians and we had no suitable ventilator. Six neonates were admitted with tetanus of which 5 died. All were managed by sedation mainly with diazepam (diazemuls to preserve venous access as generic diazepam causes loss of venous access from phlebitis in a short time). Of the six children (over one month to 18 years) admitted with tetanus all survived among whom 4 required long term IPPV for about 3 weeks when magnesium failed to control the spasms. Eleven adults were admitted with tetanus and 8 died. No adult patient who was given IPPV when magnesium failed to control the spasms survived. Long term IPPV for tetanus is a major commitment of resources and should only be embarked upon after careful planning of available resources but in our experience children gave good outcomes. At present with our limited resources we rarely start IPPV for tetanus in the older patient.

The use of a tracheostomy tube with an inner removable tube for cleaning (Portex code 100/810) made tracheostomy tube blockage a less common occurrence and more easily managed. This was especially so as we had no means of humidification besides some

donated disposable single use filter humidifiers. Eighteen patients had tracheostomies and 4 died from the underlying condition. No patient died from a complication of tracheostomy and both trained and assistant nurses became skilled at managing tracheostomy care and during the study there was no major morbidity attributed to tracheostomy. Ten patients had a tracheostomy for some form of upper airway obstruction and 6 for tetanus. Causes of upper airway obstruction included trauma to the mandible, laryngeal papillomas, Ludwigs Angina, laryngotracheobronchitis, and postoperative care of patients who had had thyroidectomies for giant goitres. It was our preference to perform a tracheostomy than leave an endotracheal tube in situ for more than one or two days as with limited means of humidification, limited nursing care and no ward resident anaesthetist, tube blockage of endotracheal tubes had been a major hazard prior to this study and surgeons were available to perform tracheostomies[5].

Our policy was to care for all patients with a tracheostomy in the ICU in order to avoid any problems with tube blockage on the main wards where suction machines are not always available. Time spent in ICU is therefore extended for some patients in a low dependency bed whose general condition may be good but this policy has meant we have had few major problems with tracheostomy tube obstruction.

There were 9 patients admitted with eclampsia all of whom survived. Unlike other areas of Sub-Saharan Africa eclampsia is an uncommon problem in the local ethnic group and when present often runs a short and mild course.

Twenty one percent of admissions had central lines placed in the internal jugular vein and 22% of admissions had femoral vein cannulae sited. Femoral vein cannulation with central lines using a Seldinger wire was very useful in the longer stay patients where venous access became problematic. The equipment item of primary major importance we found were oxygen concentrators, pulse oximeters and central line cannulae.

Intermittent positive pressure ventilation was carried out on 30 patients with a mortality rate of 53% (Figure 4), and the commonest group to benefit from IPPV was the post-operative general surgical patient with 13 patients of this group given IPPV with a 54% mortality. The majority of these patients were ventilated for not more than 24 hours hours. As a general policy head injured patients admitted to the ICU were not intubated or given any IPPV as our resources were limited though this policy was flexible and 2 head injured patients were ventilated with one survivor where the main indication was for sputum retention. In general if beds were available head injured patients with a Glasgow score below 12 were admitted to the ICU for close monitoring, oxygen therapy and nursing care only.

Table 4 : Intermittent positive pressure ventilation mortality

Diagnosis	Number of patients	Died	Percentage mortality
Child tetanus	4	0	0
Adult tetanus	4	4	100
Post-op general surgey	13	7	54
Post-op gynae obstetrics	6	4	67
Head injury	2	1	50
Epilepsy	1	0	0
Total	30	16	53

Discussion

Rural African hospitals are realising that there is a considerable value in setting aside some area of the hospital for a lower patient to nurse ratio and with added equipment for monitoring of patients at special risk. Oxygen concentrators and pulse oximeters are now available even in remote areas of rural Africa and from our experience it seems that the patients most likely to benefit would be post-operative surgical patients in the first instance. In planning an ICU in this environment it would be appropriate to place it near the operating theatre or recovery ward. A rational use of oxygen with a sustainable supply from oxygen concentrators monitored with pulse oximeters should be the first requirement[6, 7]. It is clinically very difficult to assess oxygen therapy without pulse oximetry especially in African patients where cyanosis is difficult to assess. Central venous monitoring by cannulating the internal jugular vein provides an important guide to fluid therapy especially in the hours immediately after surgery as well as providing secure venous access and non-physician clinical officers became very skilled in the placement of central lines.

The most expensive item of equipment in the ICU is the ventilator. Although low cost ventilators can be purchased most of these are driven by oxygen cylinders or high pressure oxygen lines. The logistic problems in rural Africa necessarily mean such machines can only be used for very short periods of a few hours as

obtaining a regular supply of oxygen cylinders is often not feasible. During the course of the study one Glostavent machine was purchased and proved very satisfactory as it is powered by an electrically driven oxygen concentrator which itself drives the ventilator[8] .Our electricity supply from the mains or back up generator was only rarely interrupted. In our experience in the rural African environment an ICU facility can make a major improvement to care and should be a natural development of all hospitals. The non-physician clinical officer and non-physician anaesthetists made substantial contributions in clinical care and placing and managing central lines and IPPV. The overall mortality of patients given IPPV was 53% and urban centres in Africa have had higher rates of mortality reported[5, 9]. A decision of whether IPPV should be initiated has a big impact on ICU workload and this judgement is crucial to avoid futile efforts or to identify potential survivors. It is our impression that our theatre and recovery ward mortality was reduced as our non-physician anaesthetists were encouraged to consider IPPV in postoperative cardio-respiratory unstable patients. The nursing morale was high despite the heavy workload which nurses experienced compared with the main wards and as a policy once nurses were trained on the unit they were not rotated to other wards. The high morale was attributed to their opportunity to increase their skills and their observation of good patient outcomes in critically ill patients. Surgical patients are the most likely group to benefit. In Uganda the ratio of rural physician anaesthetist to population is about one per 5 million and although this situation is a major hurdle to medical development it should not prevent what can still be done with current staff to develop some form of ICU facility in rural hospitals. Comparison of outcomes in sub-Saharan Africa with other ICU units in the developed world is problematic as the diagnostic case mix is so different and in the absence of reliable blood gas analysis and other laboratory results severity sickness scores such as APACHE scores cannot be performed[10]. More work is needed to develop a clinical sickness score relevant to African conditions in order to compare results both within and outside Africa and to evaluate changes in therapy. The work of Waters and Sinclair in designing an inexpensive clinical sickness score relevant to Africa needs further research if outcomes are to be compared with confidence. [11, 12.]

At present a practice of primary surgery and primary anaesthesia is an acceptable concept among rural clinicians and extending the concept of a primary ICU unit is a logical development.

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