

Critical care of burn patients in developing countries: cost versus need

Burn patients in Africa die of shock or sepsis.

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Recent reports reveal a 50% decline in burn-related deaths and hospital admissions in the USA over the last 20 years.¹ The reduction is probably a result of prevention efforts resulting in a decreased number of patients with potentially fatal burns, and improved critical care and wound management of those still sustaining severe burns.² Among those suffering moderate to severe burns and treated in First-World hospitals, most will require critical care for at least part of their hospitalisation, and some will require it for months. As many as 10% may die from complications related to the burn.¹

Unfortunately in Africa there is not enough evidence to support a decline in burn-related injuries or deaths. Burn patients in Africa die of two general causes: early deaths as a result of burn shock or late deaths as a result of sepsis and multiple organ failure. This pattern is similar to all trauma-related deaths.³

Moderately to seriously burned patients require critical care in specialised units with equipment, supplies and personnel for intensive monitoring and life-sustaining organ support until the patients recover and the wounds are healed. In the USA the Shriners Institute report a 50% mortality for burns covering 98% of total body surface area (TBSA) in children aged 14 and under.⁴ Severe burns require intensive monitoring during the resuscitative phase, especially with evidence of inhalation injury. Thereafter cardiopulmonary monitoring with positive pressure ventilation is essential for this injury, to manage burn shock, renal dysfunction and the development of systemic inflammatory response syndrome (SIRS).⁵ The average length of stay (LOS) in the burns intensive care unit (BICU) is approximately 1 day per % TBSA burned.⁶

Organisation of a burns intensive care unit

The BICU should ideally be placed within a designated burn care centre. The number of beds required in the unit may be calculated according to international standards. But in Africa, very often the financial burden of health services dictates the development of burn centres and facilities. Without any substantial information or research, the development of a BICU will probably be dismissed as too expensive. However, it is well known that when care is provided or supervised by trained specialists, patient outcomes improve and medical costs are reduced. Data indicate that the presence of a full-time ICU medical director, in partnership with a nurse manager, can dramatically decrease the length of both ICU and hospital stays and prevent patient deaths.⁶

The BICU functions best if there is a team approach among doctors, nurses, occupational and physiotherapists, dieticians, social workers and mental health professionals. The burns theatre plays a very

important part in service delivery. Dedicated anaesthetists with experienced nursing staff reduce the risk of a second insult to the seriously injured burn patient as a result of unnecessary delays in theatre resulting in hypothermia during procedures.

Nursing personnel should consist of a nurse manager with at least a few years of intensive care and acute burn care experience. The rest of the nursing staff in the BICU should have competencies specific to the care of burn patients, including wound care. Equipment used in a BICU is the same as that used in all ICUs. It is important to note that specialty equipment must also be available for burn management. This includes fibre-optic bronchoscopes for the diagnosis and treatment of inhalation injury and other pulmonary disorders as well as equipment to measure weight and body temperature. Oxygen and at least two vacuum pumps must be available for each bed.

Wound care is the most important activity in a burn unit. Taking care of the daily dressings and the special techniques, such as vacuum assistant closure (VAC) in the BICU are often lengthy procedures, taking up to 2 hours. Only trained nursing staff can provide the care necessary to improve the outcome for the burn patient.

Cost of critical care

The incidence of critical care admissions in the USA is high for infants, falls for older children, and then climbs exponentially through adulthood (114.4/1000 population group in >85 years of age).⁷ The same can be applied to burn care. The ageing population world wide means potentially increased health costs. It is estimated that the annual cost for critical care is 0.67% of US GDP and >20% of US hospital costs.⁷

The total ICU expense in South Africa is unknown, but data accumulated 4 years ago in the Tygerberg BICU revealed that the average cost per patient is R59 500. The annual cost for nursing professionals per BICU bed is R434 000.⁸ Very often such information reveals only half truths. It seems that critical care is very expensive and in developing countries not at all viable. To test this theory a recent article by Rahim *et al.*⁹ explains that since 1979, the Russell equation has been the most widely used method of estimating ICU costs in the USA. The ratio of ICU-to-ward cost per day used in the Russell equation is commonly accepted as 3:1. This was calculated from representative data from 864 ICU patients with sepsis and adult respiratory distress syndrome (ARDS), recruited between 1996 and 2000 from over 50 US hospitals. This demonstrates that, because of rising health cost and ward cost/day the ratio of ICU-to-ward cost/day is substantially lower (almost 50%) than commonly accepted.⁹

Not only has the rising cost of health care services changed the concept of critical care/ward bed cost over the last few decades, but an international programme for resource use in European critical care units also showed that cost can vary tremendously. The average cost

in US\$ per patient day in UK hospitals was \$1 512, in French hospitals \$934, in German hospitals \$726 and in Hungarian hospitals \$280.¹⁰ According to the authors the reasons for such differences are poorly understood but warrant further investigation. However, it is not difficult to imagine that there will be a difference in cost between intensivists who provide care in a single unit. It seems that the average daily discretionary costs varied by 43% across the different intensivists.¹¹ Also, policies and resources available in hospitals and different nations will dictate how much, when and where what will be spent.

The reasons for differences in cost can be listed as follows:

- Human resources are the most expensive component. In ideal circumstances there should be 3 qualified nursing staff/BICU bed/day – this goal is seldom achieved.
- Consumable expenditure can significantly influence the practice in a unit. Using expensive wound coverage and disposables will push up the account.
- Pharmaceuticals and special investigations in the BICU will very often be the same as in any other ICU, with sepsis and complications being the main cause of expense.
- There has, fortunately, been a substantial decrease in blood products used in the BICU over the past 5 years as a result of blood-saving techniques. However, they are still expensive.
- In any ICU equipment is the most overrated expense. The initial lay-out is generally expensive but using it daily over 5 - 6 years brings down the price substantially.

Besides the expense already mentioned, some procedures or programmes will increase costs. A total parenteral feeding (TPN) programme is contraindicated in the burned patient. Oral feeding is more beneficial and less expensive, but sometimes it is essential to use TPN, which will increase costs threefold.

Surgical procedures are the backbone of burn management, but taking the patient to theatre and using skin substitutes will increase the cost 3 - 5 times.

Outsourcing human resources is another important reason for rising costs. Nursing staff is in demand world-wide. Safe practice in any ICU requires a critical minimum of staff. When that cannot be obtained with permanent staff outsourcing becomes necessary, but is very expensive.

Tygerberg Adult Burn Unit (TABU) critical care admission

Before looking at the admission rate into the critical care facility it is important to look at

the profile of burn patients admitted annually into such a tertiary institute. Assaults comprise 37% of all admissions. Both fire and boiling water (liquids) are used and very often alcohol abuse is involved and the victim will know the perpetrator. Suicide attempts (3%) are on the increase, especially among young females living with the reality of HIV infection. Domestic accidents, e.g. where cloths brush against open fires, a candle topples over, a victim rolls in fire while asleep or while having an epileptic fit, or highly flammable liquid is thrown on fire and ignites clothes, make up another 30% of burn injuries. Once again intoxication and substance abuse contribute to the accidents. Flame stove explosions igniting clothes and causing serious injury show a definite decrease in incidence and comprise 9% of admissions. Legislation controlling the manufacture of unsafe stoves has already had a positive influence. Work-related and other industrial accidents account for 8% of admissions. Electrical accidents are also increasing (3%) because of people stealing copper cables and unqualified people attempting to work with high-voltage lines to tap electricity in informal settlements. Another 10% of admissions are attributed to causes such as motor vehicle accidents, smoking, eating or substance abuse (Table I).

Patients admitted to the TABU over a period of 9 years (1997 - 2005) are shown in Fig. 1. The average number of admissions annually was 339, with 146 admissions into the critical care facility. Patients admitted to the BICU comprised 47.4% of annual admissions.

The criteria for patients admitted into the ICU vary from unit to unit. Not all the patients admitted into the TABU need critical care. The risk factors for a new admission in the BICU include:

- severity of disease with extensive burns
- inhalation injury with/or face, neck and chest wounds
- a compromised patient with pre-existing disease

Table I. Causes of burn injury

Assaults	37%
Suicide attempts	3%
Domestic accidents	30%
Flame stoves	9%
Industrial accidents	8%
Electrical accidents	3%
Other	10%

- moderate burns in a fragile patient – very old, very young or otherwise compromised.

After resuscitation the patients need critical care:

- when postoperatively compromised and unstable
- when in organ failure and support is essential
- when sepsis and multi-organ failure threaten.

Patients in a BICU are very fragile with severe immune suppression. Infection, sepsis and multi-organ failure are constant threats. Mortality is high, even with maximal support (Table II). Over a 9-year period the percentage of patients who survived from the BICU decreased by almost 20%. Definite reasons cannot be given, but this sharp decrease is probably because of nosocomial infections that are impossible to control in patients with pre-existing disease when compromised immune function is present. Those who survived critical care, though scarred or disabled, would never have survived without the time spent in the ICU. The overall mortality rate for the TABU is shown in Table II.

When evaluating outcome, survival is important but LOS is an important determinant of financial factors and then it takes preference. Costs can be established by comparing patients with 15 - 30%TBSA burns admitted either to the ICU or ward beds. Admission into the ward happens frequently when patients with 15 - 30%TBSA burns are

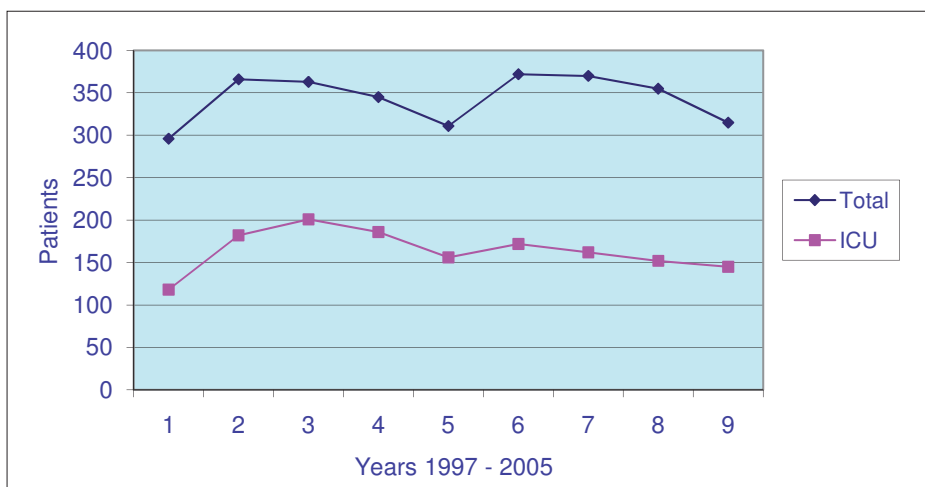


Fig. 1. Patients admitted to the Tygerberg Adult Burn Unit.

Critical care

not compromised, without inhalation injury or happen to be stable postoperatively and then do not need ICU admission. Fig. 2 shows, over a 9-year period, the average monthly LOS for patients who survived 15 - 30% TBSA burns when managed with and without critical care. Although the differences are not statistically significant, it seems that the patients with ICU management stayed 23.5 days and the patients admitted into ward beds remained for a period of 28.5 days. This emphasises again the concept that when care is provided or supervised by trained specialists the outcome improves.

Conclusion

Critical care improves patient outcomes and saves lives. Medical costs can come down for many reasons but the most important

is because LOS decreases. Each patient discharged into the step-down facility and rolled into rehabilitation is a life saved and a survivor to be a breadwinner or a mother who can care for her family.

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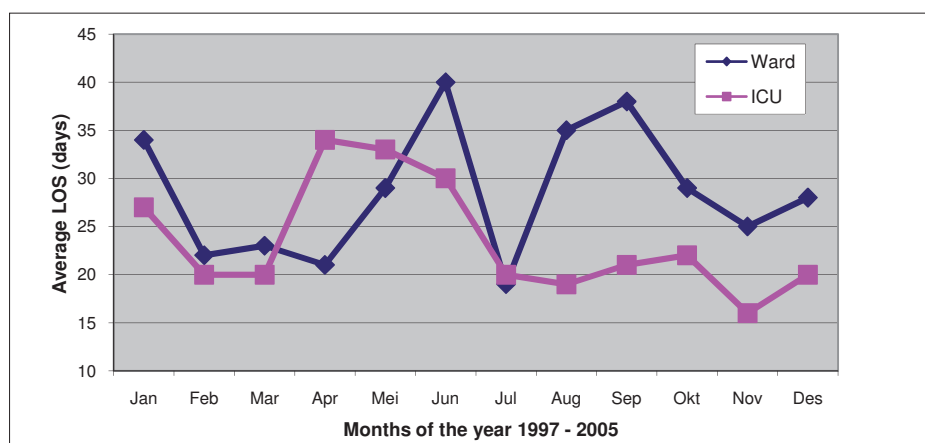


Fig. 2. Average monthly LOS in patients with 15 - 30% TBSA burns, 1997 - 2005. ICU: 23.5 days (16 - 33), ward: 28.5 days (18 - 37).

Table II. Overall mortality rate for the Tygerberg Adult Burn Unit

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005
Patients survived from critical care	64 (54%)	80 (44%)	95 (47%)	81 (44%)	77 (49%)	85 (49%)	78 (48%)	65 (42%)	51 (35%)
TABU mortality rate	53 (18%)	102 (27%)	111 (32%)	105 (30%)	78 (25%)	87 (23%)	86 (23%)	87 (25%)	96 (30%)

In a nutshell

- Most patients with moderate to severe burns will require critical care for part of their hospitalisation.
- Burn patients die of two general causes – early death as a result of burn shock or late death as a result of sepsis and multi-organ failure.
- Seriously burned patients require critical care for life-sustaining organ support until they recover and the wounds are healed.
- When care is provided or supervised by trained specialists, patient outcomes improve and medical costs are reduced.
- Wound care is the most important activity in a burn unit.
- The total ICU expense in South Africa is unknown, but data accumulated in a BICU revealed that the average cost per patient is R59 500.
- Because of rising health costs and ward cost per day the ratio of ICU-to-ward cost/day is substantially lower (almost 50%) than commonly accepted.
- The most important reason for adding to expense is definitely when human resources are outsourced.
- Each patient discharged into the step-down facility and rolled into rehabilitation is a life saved and a survivor to be a breadwinner or a mother who can care for her family.