

Outcomes of burns patients in a developing country: A single centre's experience

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Background. Pelonomi Tertiary Hospital is the only hospital in the Free State Province with a burns unit. We do not have official data to assess our performance in the management of burns.

Objective. To determine the Lethal Area 50 (LA50) index for the Pelonomi Tertiary Hospital's burns unit. Furthermore, to determine the morbidity that affects burns patients at the institution, and the factors associated with outcomes.

Methods. We used Redcap to capture demographic and clinical data of burn patients admitted to our institution between January 2014 and December 2018. Logistic regression was used to determine significant predictors of the outcomes. The LA50 was calculated by performing a probit regression of survival by total body surface area (TBSA). We used SAS 9.4 statistics software package.

Results. Our study had a male preponderance, with 59.7% (601) male, 39.9% (401) female and 0.4% (4) missing sex. We had a mean age of 19.4 years, of which 53.38% ($n=537$) were paediatric patients and 46.32% ($n=469$) adults. The mean length of hospital stay was 16.88 days. Our LA50 was 37%, and the overall mortality was 14.63%, with a mean age of 33.96, a mean TBSA of 43.3% and a mean revised Baux score of 80.55 for the mortality group. The paediatric group had a 5.03% ($n=27$) mortality rate, with 88.88% of these being children under 5 years with an LA50 of 45%, and the adult group had a 25.56% ($n=120$) mortality rate with an LA50 of 34%. Factors associated with mortality were age ($p<0.0001$), TBSA ($p<0.0001$), female sex ($p=0.4126$), full-thickness burns ($P=0.7160$) and burns to the head ($p=0.9038$). The leading cause of injury was hot water (46.5% of patients), followed by fire at 38.6%. HIV was the leading comorbidity, affecting 6.9% ($n=67$) of patients, followed by hypertension at 4.67% ($n=47$), and 2.58% ($n=26$) of patients had epilepsy. The leading complication was sepsis, affecting 14.67% ($n=144$) of patients. The average waiting time between admission and skin graft was 25.29 days, and for debridement was 3.57 days.

Conclusion. The epidemiology of burn patients and working conditions at Pelonomi Tertiary Hospital are similar to other burn units in the country; however, our mortality rate is higher than at most centres. The LA50 is low, but in keeping with the rest of Africa, and our predictors of mortality are in keeping with those found in other studies in other parts of the world.

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Burns constitute a major public health problem, especially in low- and middle-income countries, where over 95% of all burn deaths occur, with Africa contributing 15% of global burn mortality.^[1,2] The consequences of burn injuries are not only limited to patients' physical health: they also affect social, economic and physiological domains of a patient's life.^[3] Most burns involving 25% of the total body surface area (TBSA) can be managed without critical care. However, as the burn size increases above this point, especially in young, old, or medically frail patients, mortality increases sharply unless critical care support is provided.^[4] Successful initial treatment of burns is determined by timeous aggressive resuscitation encompassing nutrition, infection control and early wound excision and grafting. The early introduction of enteral feeds has demonstrated an improvement in burn patients' outcomes by mitigating the degree and extent of catabolism.^[5] A well planned protocol-based management of burns patients by burns teams consisting of dedicated healthcare professionals, even within a resource-constrained environment, can decrease the high mortality associated with major burns that require hospitalisation.^[6] The main principles in managing burn injuries in a specialised burn unit are controlling pain and infection, providing and maintaining a moist environment, and preventing heat, fluid, and protein loss.^[7] Burn patients with modest chances for survival can be treated successfully. However, optimal working conditions that include the availability of scarce and expensive resources such

as critical care services, modern dressings and access to operating theatres are mandatory for successful treatment.^[8,9] The optimal management of burn patients is expensive, and even after survival, they may need medical, surgical, psychological and rehabilitation intervention for many years.^[10]

A dependable outcome measure tool used to compare the quality of care in burn centres is the Lethal Area 50 (LA50) index, defined as the extent of burn TBSA associated with 50% mortality.^[11] Improvement in treatment will be reflected in the rise of LA50.^[12] However, it should be noted that LA50 on its own is not a conclusive index for the performance of a burn department, and its interpretation should be done together with the standard mortality ratio (SMR).^[13] SMR was not part of the scope of this research, but is mentioned to highlight the limitations of using LA50 alone as a tool to assess the performance of a burn unit. It is estimated that 3.2% of the South African (SA) population sustain burn injuries each year. The majority of these burns are minor and moderate, with <10% being severe and needing specialised care.^[14] Chronic resource constraints have been linked with poor outcomes in SA and the rest of Africa compared with high-income countries. Mortality rates can be as high as 30%, with LA50 around 40%.^[2]

In our setting, there has not been a study done to look at the outcomes of our patients. There is, however, a perception that patients with extensive burns of a TBSA >35% do not have good

outcomes. Therefore, we want to examine the outcomes for the burns patients admitted to our institution and determine the LA50 index for our burns unit. The outcomes will be length of hospital stay, in-hospital mortality and morbidity.

Objectives

To determine the outcomes of burns patients admitted at Pelonomi Tertiary Hospital.

The objectives were:

- to determine the LA50 index for the Pelonomi Tertiary Hospital's burns unit
- to determine the morbidity that affects burns patients at the institution.
- to determine factors associated with outcomes.

Methods

Study design and sample

The study was a historical cohort analysis of burns patients admitted to Pelonomi Tertiary Hospital between January 2014 and December 2018. We included all burns patients admitted during the study period. We anticipated at least 450 patients, and we enrolled 1 006 patients. We excluded patients admitted for elective skin grafting.

Study setting

Pelonomi Tertiary Hospital is in the Mangaung Metropolitan Municipality in the Free State Province of SA. This is the only trauma centre in the province and receives patients from across the province. There is a 9-bedded multidisciplinary intensive care unit (ICU) and five paediatric ICU beds. The burns unit has 10 paediatric and 15 adult beds (2 high-care beds and 13 general beds). One trauma surgeon consultant, a general surgery registrar and an intern manage the adult burns unit. A paediatric surgeon consultant, one registrar and a medical intern manage the paediatric burns unit. We do not have a dedicated burns ICU or theatre; adult patients who require ICU admission are co-managed with the multidisciplinary ICU team, and paediatric patients admitted to ICU are co-managed with the paediatric intensivists. The theatre is in the main theatre complex, shared with other surgical disciplines, with the Burns Unit having a half-day list every week.

Measurement

Study data were collected and managed using REDCap (Research Electronic Data Capture; Vanderbilt University, USA), hosted at the University of the Free State. REDCap is a secure, web-based software platform designed to support data capture for research studies. We captured the patient's demographic (date of birth, age, sex) and clinical (TBSA, cause, depth of burns, location inhalation, modified Baux score, comorbidities, complication, surgical procedure and date) data. Presence of inhalation injury was based on clinical suspicion of the admitting doctor. Information was sourced from the MEDITECH electronic patient clinical notes and data system, patients' physical files, and Department of Surgery morbidity and mortality data. Only information from the index admission (the period from admission until discharge home or mortality) was recorded. Files with missing data were not excluded: we recorded the available data, which formed part of the final analysis.

Pilot study

A pilot study was conducted with 10 patients, 2 selected from each year of the study. These patients were included in the main study. No changes to protocol or datasheet were made after the pilot study.

Analysis of data

Results were summarised using categorical and numerical data. The descriptive analysis presented as frequency, percentage and means. A stepwise selection model, using $p > 0.4$ as a significance level, was used to select predictors that would go into the model, and those ≥ 0.4 were retained. The LA50 was calculated by performing a Probit regression of survival by TBSA. We used SAS 9.4 software package (SAS Institute Inc., USA).

Ethics

The study protocol was approved by the Health Sciences Research Ethics Committee of the Faculty of Health Sciences (HSREC), University of the Free State (ref. no UFS-HSD2019/1783/2502).

Results

Over the study period, 1 190 burn patients were admitted during the study period. Of these, 1 058 files were retrieved. A total of 52 patients were excluded from the final analysis. For 132 patients, no records were available. Of the included number, 738 (73.4%) files had complete information, and 268 (26.6%) files had incomplete data.

Demographics

We admitted 39.9% ($n=401$) females and 59.7% ($n=601$) males; 0.4% ($n=4$) patients had missing sex probably owing to a clerical error. Female sex was associated with an increased probability of death; however, it was not statistically significant ($p=0.4126$). The age range was between 2 weeks and 97 years; the mean (standard deviation (SD)) age was 19.4 (19.5) years. There were 53.38% ($n=537$) paediatric patients, and 46.32% ($n=469$) were aged >12 years. Fig. 1 breaks down the patients in terms of age. In the paediatric group, 13.78% ($n=74$) were <1 year, 333 (62.01%) were between the ages of 1 and 4 years, with 137 (24.21%) aged between 5 and 12 years. Age was a significant predictor of mortality ($p < 0.0001$).

Inpatient details

Our study population consisted of 1 006 patients, of whom 91.85% ($n=924$) of the patients admitted to the burns ward, and 8.15% ($n=82$) were admitted to the ICU. The mean (SD) length of stay (LOS) was 16.87 (24.17) days, with the longest duration of 241 days. The mean (SD) overall LOS in ICU was 11.8 (17.5) days, the minimum stay was 1 day and the longest was 133 days. Fig. 2 summarises the mechanism of burn injury. Of the patients admitted to ICU, 64.6% ($n=53$) were males and 35.4% ($n=29$) females. The mean (SD) TBSA was 33.68% (15.02), with 86.59% ($n=71$) of the patients sustaining TBSA of $\geq 20\%$. Fire was the leading cause, affecting 65.4% ($n=53$), followed by hot water 23.5% ($n=19$) of patients. Of these ICU admissions, 51.2% ($n=42$) of patients died, and the leading complication for this group of patients was sepsis, affecting 58.5% ($n=48$) of patients. The mean (SD) duration of stay in ICU for the mortality group was 11.0 (14.57) days.

TBSA was documented in 92.45% ($n=930$) of patients, with a mean TBSA of 18.17%, and 7.55% ($n=76$) did not have a documented TBSA. A total of 32.21% ($n=324$) patients sustained TBSA of $<10\%$, 27.83% ($n=280$) sustained burns between 10 and 19% and 24.85% ($n=250$) sustained a TBSA between 20 and 40%. Patients with TBSA between 40 and 60% constituted 4.15% ($n=42$), and 3.38% ($n=34$) sustained TBSA $>60\%$. An increase in TBSA was associated with an increased likelihood of death ($p < 0.0001$). Most patients had mixed thickness burns, with 40.76% ($n=410$) sustaining superficial burns as part of their overall burns. Superficial thickness burns were protective from death ($p=0.0007$), while 12.6% ($n=127$) of

the patients sustained full-thickness burns. However, 23.26% ($n=234$) did not have a documented depth of burns. Full thickness

was associated with an increased likelihood of mortality, though not statistically significant ($p=0.7160$). Inhalation injury was marked as

absent in 73.54% ($n=731$) of patients, while 8.6% ($n=85$) of patients had documented inhalations burns, and 17.9% ($n=178$) had no documentation of presence or absence of inhalation. Our patients sustained burns in multiple body parts (Fig. 3).

Fig. 4 is a graphic representation of the different comorbidities and Fig. 5 demonstrates the mortalities according to the different age groups in our study population.

The mean revised Baux score was 38.1. The majority of the patients (61.7%; $n=602$) had no comorbidities, while for 20.77% ($n=209$) patients, presence of comorbidity was unknown. The HIV prevalence rate was 6.9% ($n=67$). Mental healthcare users constituted 1.39% ($n=14$) of patients (5 patients had depression, 2 had schizophrenia, 4 had psychosis that was not classified, 2 patients had intellectual impairment, 1 was not specified). The pregnancy prevalence rate was 0.3% ($n=3$). One patient (0.1%) had metastatic prostate cancer, and 0.5% ($n=5$) of patients were homeless and needed social worker intervention for placement into a place of care. Of the pregnant patients, 2 were HIV-positive, and only one patient delivered a still birth in the ward. Epilepsy was documented in 2.58% ($n=26$) of patients, 7.69% ($n=2$) paediatric and 92.31% ($n=24$) adult.

Surgical procedure

Some patients had multiple procedures performed, owing to the need for staged debridements or grafting. We only recorded the initial procedure if a patient had the same procedure more than once. Of all patients, only 16.2% ($n=163$) had skin grafts, 14.91% ($n=150$) were debrided and 60.14% ($n=605$) did not have any surgical procedure performed. We also had 2.49% ($n=25$) of patients who had amputation surgery (ranging from a digit to a limb). A further 1.99% ($n=20$) of patients had a tracheostomy, with 1.29% ($n=13$) needing other procedures, of whom 3 required a

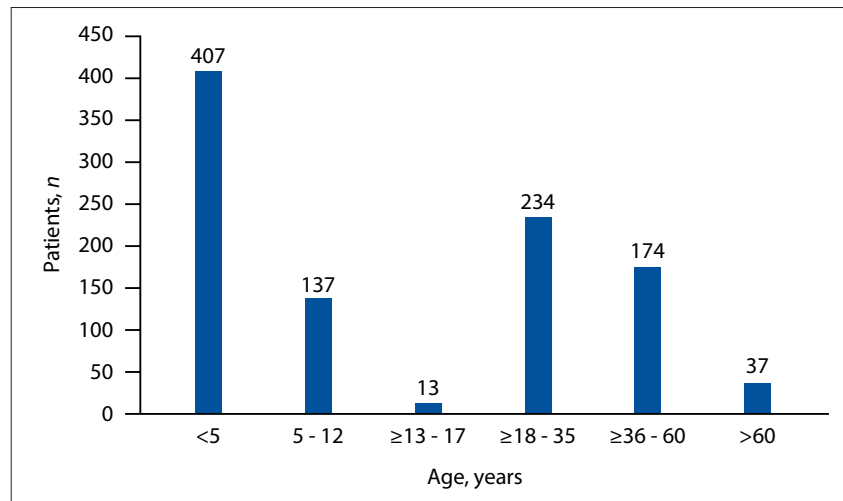


Fig. 1. Patient age categories (N=1 002).4 patients had missing age

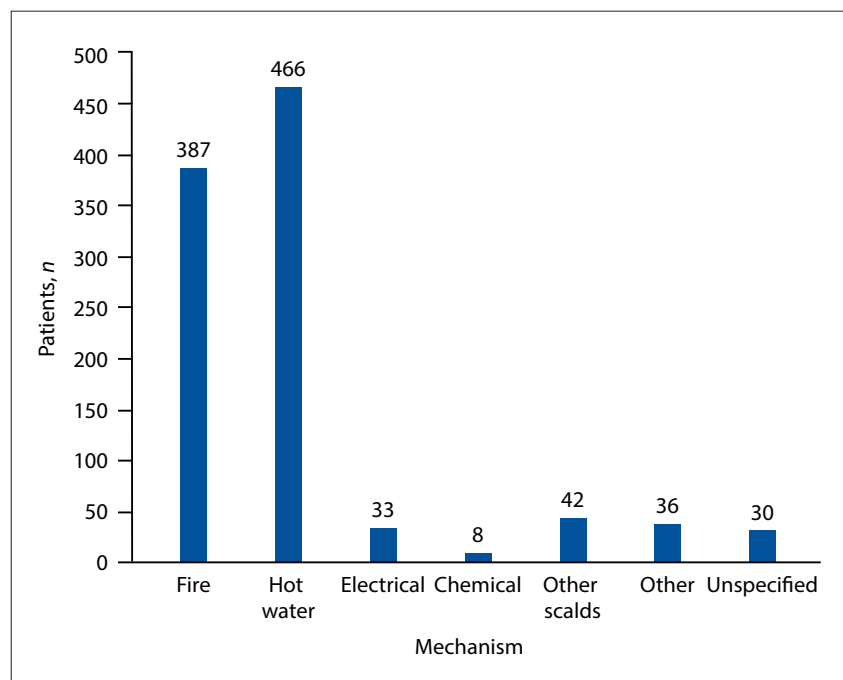


Fig. 2. Mechanism of injury (N=1 002; 4 had missing information).

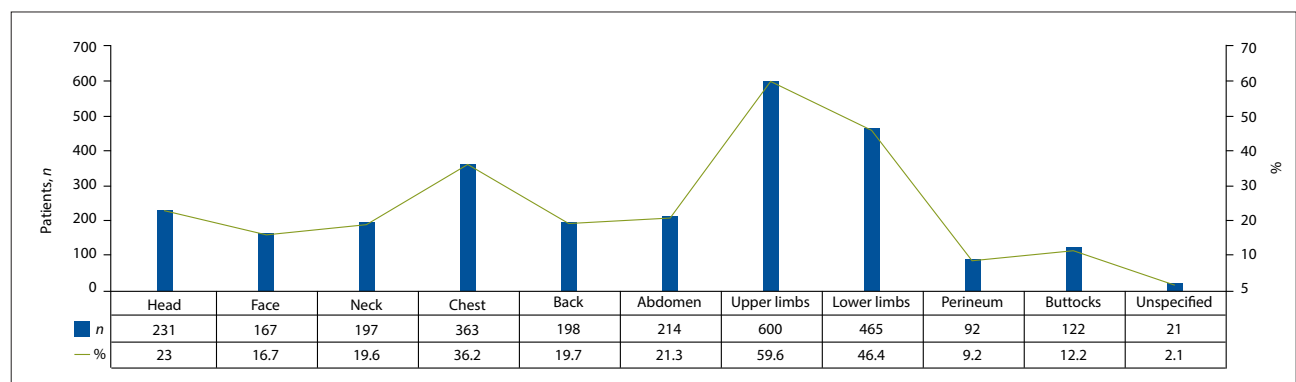


Fig. 3. Location of burns (N=1 006).

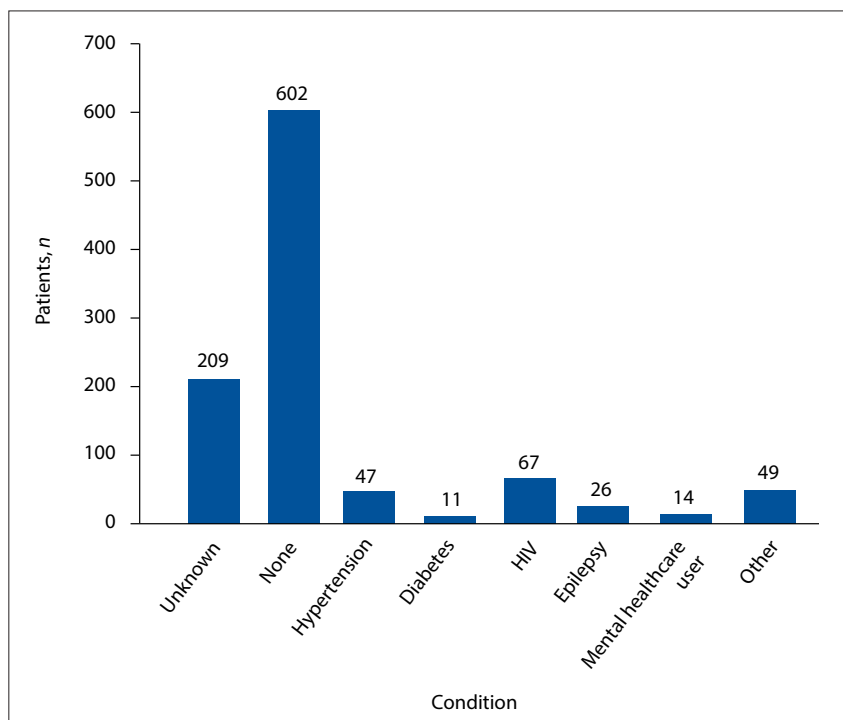


Fig. 4. Patient comorbidities (n=195).

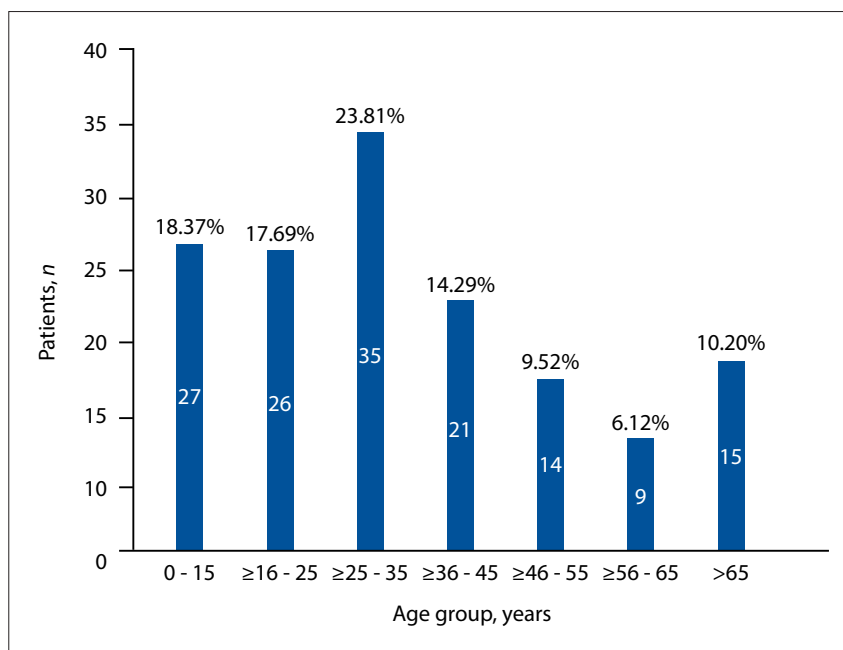


Fig. 5. Mortality by age group (n=147).

laparotomy (1 for abdominal compartment syndrome and 2 for upper gastrointestinal bleeding (UGIB). A total of 136 patients who had missing information. The mean number of days between admission and skin graft for our patients was 25.3, and that for debridement was 3.57 days.

Outcomes

Sepsis was the leading complication, affecting 15.2% (n=144) of patients, with

1.4% (n=13) having developed contractures. Other complications are as follows: 0.8% (n=8) acute kidney injury; 0.8% (n=8) rhabdomyolysis; 0.89% (n=9) hospital-acquired pneumonia; 0.39% (n=4) ventilator acquired pneumonia; and 2.29% (n=23) other complications. Complications were not associated with mortality. We had 85.37% (n=858) patients discharged from the hospital, with 147 deaths, accounting for an overall 14.63% mortality rate, and

1 patient with an unknown outcome. The mortality group consisted of 35.6% (n=52) females and 64.4% (n=94) males, and the mean age was 33.96 years. The paediatric group had a 5.03% (n=27) mortality rate, with 88.88% (n=24) of the mortalities being children under 5 years. There were 120 deaths, equating to a mortality rate of 25.56% in the adult group. The leading cause of burns was fire, in 81% (n=119) of the patients, hot water (13.6%; n=20), 1.4% (n=2) electrical burns, 2% (n=3) unspecified and 2% (n=3) other causes (2 gas explosions and 1 cooking oil). Mean TBSA was 43.3%, with a minimum of 7% and a maximum of 96%. The mean hospital LOS for the group was 11.55 days, with the longest-staying patient succumbing after 89 days. In this group, 28.6% (n=42) of the patients were admitted to ICU, with a mean (SD) ICU stay of 11.02 (14.5) days. A total of 37.2% (n=54) patients sustained inhalation injuries, while 27.6% (n=40) had no inhalation injuries, and in 51 (35.3%) it was not indicated. The mean revised Baux score was 83.1. In terms of procedures, 25.1% (n=37) of patients had debridement, 9.52% (n=14) escharotomies, 11.56% (n=17) tracheostomies, 2.04% (n=3) amputations and 2.04% (n=3) other operations. The most commonly affected area was the upper limbs, with 74% (n=108) sustaining burns to this region, followed by the lower limbs. The leading comorbidity was HIV, which affected (12; 8.7%) patients, followed by hypertension (7; 5.4%). Furthermore, 4 (2.9%) patients had epilepsy. Sepsis was the leading complication among this group, affecting 45 (34.9%) of patients, and 10.1% (n=15) of patients had other complications, including acute kidney injuries, rhabdomyolysis, UGIB, disseminated intravascular coagulopathy (DIC), and hospital-acquired pneumonia, among others. The LA50 for the unit was 37% for patients aged 12 years and below, LA 50 was 45% and for patients aged ≥13 years, LA50 was 34%. Table 1 shows a comparison between paediatric and adult burn patients.

Discussion

This study reviewed 1 006 burn patients admitted to the Pelonomi Tertiary Hospital burns unit over 5 years. There was a linear relation between death and age; in general, elderly patients have thin skin, decreased sensation and decreased metabolic capacity and reserves, often compounded by pre-existing medical conditions. They tend to have poor outcomes despite sustaining minor burns.^[15]

Burns are common among children, and the highest incidence occurs between ages 0

and 4 years. Our study demonstrated a similar pattern to others.^[16,17] Our sample contained more children (53.38%) than adults (46.32%). There were 401 females (40.02%) and 601 males (59.98%). Female sex was associated with an increased probability of mortality, though statistically not significant ($p=0.41$). Our mortality rate was 14.3%.

We compared our findings with those of other burn units in the country. Table 2 compares our performance with other centres. Our mortality rate is the third highest, which is concerning. Most other centres have a mortality rate of <10%. Many studies have shown that early excision and grafting improve outcomes, and the lack of a dedicated burns ICU and adequate theatre time for early excision and grafting might be a contributing factor to this mortality rate. The paediatric population had a lower mortality rate of 5.03%, which was lower than those in studies done at Chris Hani Baragwanath^[18] and

Nkosi Albert Luthuli hospitals.^[19] The second highest mortality rate is that of Chris Hani Baragwanath Hospital adult burn unit, which was stable at 21% from 2005 to 2015.^[20] A prolonged hospital stay was associated with higher TBSA, flame burns and severity of burns. Moving forward, close attention needs to be paid to this group of patients to ensure that they have a shorter hospital stay.

The 15.2% rate of sepsis is concerning given the fact that the mean waiting time for debridement is 3.57 days, and the mean waiting time for skin graft is 25.3 days. This delay in grafting is multifactorial, but the lack of a dedicated burns theatre or at least a full day list is a contributing factor. The lack of access to dermal substitutes while waiting for grafting is also a compounding factor for the sepsis rate. Our patients' most commonly affected body area was the upper limbs and lower limbs, affecting 59.6% and 46.4% of patients, respectively;

Table 1. Comparison between paediatric and adult burn patients*

Variable	Paediatrics	Adults
Total, <i>n</i>	537	469
Female, <i>n</i>	247	154
Male, <i>n</i>	287	314
Cause, <i>n</i> (%)		
Fire	80 (15.7)	307 (64.4)
Hot water	379 (71.1)	87 (18.6)
Electrical	13 (2.4)	20 (4.3)
Chemical	0	8 (1.7)
Other	41 (7.7)	42 (8.9)
Unspecified	15 (2.8)	10 (2.1)
TBSA (mean, SD, %)	13.3 (9.6)	23.67 (20.91)
Admitting ward, <i>n</i> (%)		
Burn unit	493 (91.8%)	431 (91.9%)
ICU	44 (8.2%)	38 (8.1%)
LOS ICU (mean, SD, %)	14.7 (21.61)	8.1 (10.3)
LOS hospital (mean, SD, %)	16.45 (25.59)	17.37 (22.51)
Mortality rate, <i>n</i> (%)	27 (5%)	120 (25.6%)
LA50, %	45	34
Surgical procedure, <i>n</i> (%)		
Debridement	37 (7.9)	113 (28.1)
Skin graft	59 (12.6)	104 (25.9)
Escharotomy	4 (0.9)	23 (5.7)
Tracheostomy	0	20 (20)
Amputation	3 (0.60)	22 (5.5)
Others	1 (0.2)	13 (3)
Complication, <i>n</i> (%)		
Sepsis	87 (17.4)	57 (12.8)
Contracture	4 (0.8)	9 (2)
Other	17 (3.4)	35 (7.8)

*Three patients in the paediatric group had missing sex information, and one patient in the adult group.

TBSA = total body surface area; SD = standard deviation; LOS = length of stay; ICU = intensive care unit; LA50 = Lethal Area 50; LOS = length of stay.

Table 2. Comparison of mortality rate with other South African burn centres

Institution	Study period	Patients, <i>n</i>	Mortality rate, %
Pelonomi Tertiary Hospital (present study)	2014 - 2018	1 006	14.63
Ngwelezane Hospital	2008 - 2010	423	5.91
Tygerberg Hospital	2003 - 2008	1 908	25.00
Edendale Hospital	2006 - 2008	450	8.88
Nkosi Albert Luthuli Central Hospital	2008 - 2010	462	9.10
Chris Hani Baragwanath Hospital (paediatric burns)	2009 - 2012	1 372	7.90
Chris Hani Baragwanath Hospital (adult burns)	2005 - 2015	2 701	21.10

it is not surprising that 2.9% of the study population required amputation of either a digit or a limb. It is, however, concerning that 13 patients developed contractures as inpatients. This highlights the need for intensive rehabilitation by our physiotherapist and occupational therapist, coupled with patient co-operation and good pain management. Our average waiting time for graft is shorter than the 51 days in Edendale shown by Allorto *et al.*^[21] More needs to be done to reduce the waiting period to meet the criteria for early grafting.

We had a LA50 of 37%, which is in keeping with the rest of Africa.^[2,22] However, it is lower than those of Middle Eastern and high-income countries. An Iranian study by Mobayen *et al.*^[23] demonstrated an overall LA50 of 56%. Furthermore, in Kuwait, Kashaba *et al.*^[24] demonstrated an LA50 of 63.9%. Another study in northwest Iran demonstrated an LA50 of 43.9%.^[25] Saffle *et al.*^[26] demonstrated an LA50 of 81% among young adults in the USA. These differences can be accounted for by many factors, including resource constraints, different patient profile and burn care that has to compete with communicable and non-communicable diseases, with more funding channelled towards other illnesses.

Our study population had a 6.7% HIV prevalence, lower than the national prevalence: according to Statistics SA in 2018, the estimated HIV prevalence nationally was 13.1%.^[27] Since we do not routinely test our patients, this could underestimate HIV. Edge *et al.*^[28] found an HIV prevalence of 5% in Tygerberg hospital. In Queen Elizabeth Central Hospital, Blantyre, Malawi, James *et al.*^[29] found an 11.7% prevalence rate, and found that HIV-positive patients had an increased risk of death. Sheyo^[30] found a 16.15% HIV prevalence in a Zambian study, and found that HIV status did not alter outcome. Our study findings align with those of Edge *et al.* and Sheyo, in that HIV status did not alter the outcome of burns patients.^[28,30] The association between burns and epilepsy has been well established. The injuries are morbid and may impact long-term functionality; they tend to occur during a seizure, and patients cannot withdraw from the insult.^[16,31] In our study, our epileptic patients experienced severe burns, and were mostly male. This differs from the finding of the 2015 study done in Edendale hospital.^[21] We had a 2.7% prevalence of epilepsy in our cohort, whereas den Hollander *et al.*^[19] in Nkosi Albert Luthuli Hospital found a prevalence rate of 12.7%.^[19]

Acute kidney injury is a common complication affecting ~40% of severely burned patients. It has been associated with poor outcomes. Age, TBSA, sepsis and rhabdomyolysis are known independent risk factors.^[32,33] Our study only had 8 patients with acute kidney injury and 8 with rhabdomyolysis. This could be a case of under-reporting, given that we have a 15% sepsis rate, and 32.41% of our patients sustained TBSA of $\geq 20\%$.

Overall, 8.15% of our patients were admitted to ICU, with a 51.2% mortality rate. This is much higher than the 10.7% mortality demonstrated by Brusselaers *et al.*^[34] in Ghana; however, it was lower than the 76.37% demonstrated by Johnson *et al.*^[35] in a Nigerian study. In our institution, we do not have a dedicated Burns ICU. Our patients are managed in a multidisciplinary unit by non-burn practitioners; this could contribute to the high mortality rate.

We demonstrated age ($p<.0001$), TBSA ($p<.0001$), female sex ($p=0.4126$), full-thickness burns ($p=0.7160$) and burns to the head ($p=0.9038$) to be predictors of mortality. This was in keeping with findings in other published studies.^[36,37] However, in our study, only age and TBSA were statistically significant. Inhalation injury has been shown to be a significant predictor of mortality in other studies.^[38-41] However, our study showed a contrary finding. This might result from under-reporting, owing to the fact that inhalation injury was

diagnosed based on clinical suspicion not on bronchoscopy, which could have led to patients being mislabelled, also given that 18.88% ($n=190$) of patients' inhalation injury was unknown. The lack of association between complications and mortality could be a result of under-reporting and documentation, leading to statistics not adequately reflecting an association. In our study, the mean revised Baux score for the mortality group was 83.1, and the revised Baux score has been found in many studies to be a good predictor of mortality.^[42-44] However, determining the Baux point of futility was beyond the scope of this article.

Limitations

With our study's retrospective nature, we could not retrieve some of the patient files admitted to the burns unit. We can also not determine whether TBSA was overestimated or underestimated. Some of the files had incomplete information.

Recommendations

More theatre time must be allocated for burns patients so that the patients can access early excision and grafting. Future research must look at interhospital transfer's impact on burn patients' outcomes, and determine the Baux point of futility for our unit.

Conclusion

The epidemiology of burns patients and working conditions at Pelonomi Tertiary Hospital are similar to those of other burns units in the country; however, our mortality rate is higher than in most centres. The LA50 we found is low, but in keeping with the rest of Africa, and our predictors of mortality are also in keeping with those found in other studies done in other parts of the world.

Declaration. This study was done and submitted in partial fulfilment of the requirements in respect of KM's MMed in general surgery in the Department of Surgery in the Faculty of Health Sciences in the University of the Free State

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Conflicts of interest. None.

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