

ORIGINAL PAPER

Clinical Outcome of Burns in HIV Positive Patients in Lusaka, Zambia

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ABSTRACT

Main Objective: To investigate whether the clinical outcome of HIV positive patients with burns differs from those who do not have HIV infection.

Specific Objectives:

1. To determine whether in-hospital HIV positive patients with burns are more likely to get wound infections than HIV negative patients.
2. To determine whether in-hospital mortality is higher in HIV positive patients than in HIV negative patients with burns.
3. To correlate HIV serostatus, burn wound infection, TBSA and age with burn mortality.
4. To assess the prevalence of HIV infection among burns patients admitted to the University Teaching Hospital, Lusaka, Zambia.

Design: A prospective observational cohort, hospital-based study was performed at the UTH, Lusaka, Zambia between November 2009 and November 2010. Patients with recent burns (less than 24 hours old) who presented to the hospital during this period were recruited into the study and the parameters studied included patient's demographics, HIV status, burn history, management and clinical outcome.

Results: A total of 452 burn patients with a median age of 10.5 years were recruited into the study. 414 of the patients (92.26%) were below the age of 5 years. The male to female ratio was 1:1.3 and 389 (86.06%) of the patients were burnt with hot liquids (scalds). 73 (16.15%) patients tested positive for HIV and of these 44 (60.27%) developed wound infection. Mortality occurred in 7 (9.59%) HIV positive patients. Wound infection occurred in 150 (39.58%) of the 379 HIV negative patients and 57 (89.06%) of the mortalities were HIV negative.

The average CD4 percentage of the HIV positive burn patients who died was 21.23% while for those who were

discharged was 17.83%. The average CD4 percentage in HIV positive patients who developed wound infection was 18.88% while the average percentage for HIV negative patients with wound infection was 17.04%. Of the 64 mortalities which occurred during the study, 55 (85.94%) of the patients had more than 15% TBSA burnt.

Conclusions: The majority of burn cases admitted to UTH are below the age of 5 years. HIV positive patients are more likely to have burn wound infections than those who do not have HIV ($p = 0.001$). The HIV status of a burns patient does not significantly alter the outcome of burns in terms of mortality ($p = 0.221$). There is no difference in the prevalence of HIV infection in burn patients and the general population.

INTRODUCTION

A burn is defined as an injury to the skin or other organic tissue primarily caused by thermal or other acute trauma. It occurs when some or all of the cells in the skin or other tissues are destroyed by hot liquids (scalds), hot solids (contact burns) or flames (flame burns). Injuries to the skin or other organic tissues due to radiation, radioactivity, electricity, friction or contact with chemicals are also identified as burns¹.

Zambia and other developing countries in the sub-Saharan region have been severely affected by Human Immunodeficiency Virus (HIV) infection and Acquired Immunodeficiency Syndrome (AIDS). Although only 12% of the world's population lives in this region, more than 67% adults and nearly 90% of children infected with HIV live here. More than 75% of global deaths due to AIDS-related illnesses in 2007 occurred in sub-Saharan Africa². Children have been much affected by the AIDS epidemic in Zambia. In 2005, there were approximately 710,000 children living with HIV/AIDS in the country³.

Significant thermal injuries induce a state of immunosuppression that predisposes burn patients to

infectious complications⁴. Infections are reported to be the main cause of death following burn injuries⁵. Gram-positive bacteria often colonize the burn wound within days after the thermal injury and Gram-negative bacteria follow after approximately one week^{6,7}. Bacterial invasion into healthy tissue often results in septicaemia and high mortality^{8,9}. The risk of spread into viable tissues and septicaemia is increased by immunosuppression^{10,11,12}.

LITERATURE REVIEW

Little is found in the literature concerning the treatment and outcome of patients suffering from HIV infection who are treated for burns. Current literature also provides little information on how to manage an HIV positive patient with burns severe enough to warrant hospital admission. In the literature reviewed, there are conflicting results and statements on the clinical outcome of HIV positive patients with burn wounds.

Worldwide

D Brett et al examined a registry of 31, 338 adult patients admitted with acute burn injury to 70 burn centers throughout the United States of America. They sought to determine whether and to what extent pre-existing medical comorbidities influence mortality risk and length of hospitalization in patients with acute burn injury¹³. This study concluded that a number of pre-existing medical conditions influence outcomes in acute burn injury. Patients with preburn HIV/AIDS, cancer, liver and renal disease have particularly poor prognosis¹³.

In Africa

T. Sjöberg and associates in Zimbabwe conducted a prospective study to assess the immune response in burn patients in relation to HIV status, clinical signs of sepsis and burn wound size¹⁴. Twenty burn patients and 10 healthy volunteers were included in their study. Six burn patients were HIV positive. Clinical signs of sepsis were observed in 10 patients. The researchers found that CD4 counts were lower in burn patients compared to non-injured healthy volunteers, indicating that burn injury results in immunosuppression. HIV infected burn patients had lower CD4 counts than HIV negative patients. Patients with clinical signs of sepsis had lower CD4 counts compared to patients without sepsis. There was no difference in the mortality rate or length of hospitalization between the patient groups. Their conclusion was that burn injury, HIV infection and sepsis independently result in immunosuppression¹⁴.

Similarly, J. James et al found that both HIV status and the total body surface area burned were independent predictors of CD4 count, supporting the notion that burns induce cellular immunosuppression. They evaluated 342 patients, including both adults and children, in a Malawi burns unit. Forty of the 342 patients tested positive for HIV (11.7%). They found that mortality was higher among HIV positive individuals and HIV positive patients were more likely to die from sepsis compared to HIV negative patients. They also found that HIV positive patients who did not develop infection or recovered from an episode of sepsis had similar hospital stay, need for skin grafting and graft take as HIV negative patients. There was no difference in pathogens cultured from wound swabs taken from HIV positive and negative patients. Patients with TBSA burned greater than 30% had nearly 100% mortality rates irrespective of HIV serostatus. But among patients with 10-30% TBSA burned, HIV positive patients compared to HIV negative patients were twice as likely to die in the hospital¹⁵.

In contrast, a study at the University of Stellenbosch in South Africa found no significant difference in the outcome between HIV positive and negative burn patients in terms of mortality or morbidity measures. Thirty-three patients formed the HIV positive study group. The study excluded patients below the age of 15 years. They concluded that a HIV positive patient, who suffers from a burn wound and has no stigmata of AIDS, should be treated similarly to an HIV negative patient¹⁶.

In Zambia

Burn injuries are a common form of trauma in Zambia and are a significant source of morbidity and mortality. Review of the University Teaching Hospital (UTH) Male and Female Surgical Admission Ward records and Mortality and Morbidity Surgical Audits over a period of twelve (12) months, between 1st January 2007 and 31st December 2007, showed that 851 (6.68%) burns patients were admitted out of a total of 12, 746 surgical admissions. 492 (57.8%) of these patients were below the age of 5 years, 168 (19.7%) aged between 5-14 years and 191 (22.4%) above 14 years of age. Of these, 723 (85%) were discharged and 128 (15%) died (UTH unpublished data).

A comparative and prospective study on the early clinical outcome of HIV seropositive and seronegative surgical patients at the University Teaching Hospital in Lusaka by Odimba et al showed that untreated HIV infected patients stayed longer in hospital than the treated ones. They also found that HIV seronegative surgical patients had less

wound infections and faster wound healing than the HIV seropositive patients¹⁷.

METHODS

Study Site and Duration

This study was conducted at the University Teaching Hospital (UTH), Lusaka, Zambia, Male and Female Surgical Admission Wards and all General Surgical Wards with burns patients from November 2009 to November 2010.

Study Design

This study was a Prospective Observational Cohort Study.

Case Definition

In this study, a case referred to a patient with recent burns, i.e. burns less than 24 hours old.

Inclusion criteria

All patients admitted with recent burns (less than 24 hours old) Patients with burns with TBSA less than 45% Consented patients

Exclusion criteria

Patients with old burns (more than 24 hours old) Patients with burns with TBSA 45% and above Non-consented patients Patients with other medical conditions such as sickle cell disease, heart disease, renal failure, cancer or other chronic disease.

Sample Size

A total of 452 patients with burns met the inclusion criteria.

Study Protocol

Recruitment and Consent Process

A Study Information Sheet was given to the patient or guardian and a written consent was obtained. A study questionnaire was then administered. The questionnaire recorded the following information:

1. Socio-demographic data
2. History of the burn
3. Past Medical and Drug History

Blood samples were collected for HIV serology, Full Blood Count and CD4 count. All HIV positive patients with were recruited as cases and all HIV negative patients were taken as controls.

Follow Up

Patients were reviewed daily in the first week and then every other day after that and as need arose (e.g. as laboratory test results become available or if the condition changed). During this review, the general condition of the patient, vital signs, wound healing progress, wound appearance, infection, urine output and any complications were noted and recorded.

End Point

End of patient follow-up was when the patient was discharged from the hospital or when mortality occurred.

Data Collection

Data was collected on pre-designed Questionnaires and Admission Forms at the time of patient enrolment into the study on admission. Review of patients and review of case notes and laboratory results was done whilst the patients were admitted and the data was collected on pre-designed Follow Up forms.

Data Entry and Analysis

Data collected was entered into Epi data software and then it was exported to STATA 10 software for analysis.

Primary outcome was mortality. Secondary outcome was wound infection rate. Baseline characteristics of HIV positive and negative patients were assessed using Chi-squared test for categorical variables and student t-test for continuous variables.

Study Limitations

Viral Load (VL) testing was not done due to financial constraints.

ETHICAL CONSIDERATIONS

This research project involving human beings was approved by the Biomedical Research Ethics Committee of the University of Zambia (UNZA).

RESULTS

Table 1: Pooled Results. Patient characteristics of 452 patients included in the study

Males		196	(43.4%)	
Sex				
Females		256	(56.6 %)	
Age (years)	0 – 5	417	(92.26%)	
	6 – 10	12	(2.65%)	
	11 – 15	4	(0.88%)	
	>16	19	(4.20%)	
Cause of the burn	Hot liquids	389	(86.06%)	
	Friction	Flames	54	(11.95%)
		3	(0.66%)	
		Electricity	3	(0.66%)
		Chemicals	3	(0.66%)
TBSA(%)	1 – 10	298	(65.9%)	
	11 – 15	80	(17.7%)	
	16 – 25	55	(12.2%)	
	>26	19	(4.2%)	
HIV Status	Positive	73	(16.1%)	
	Negative	379	(83.9%)	
Mean CD4% if HIV +		18.17%		
Wound Infection	Yes	194	(42.9%)	
	No	258	(57.1%)	
Outcome	Mortalities	64	(14.2 %)	
	Discharged	388	(85.8%)	

Table 3: Correlation between HIV status and Wound Infection

		Wound Infection		
		N	Y	Total
HIV Status	N	229 (60.42%)	150 (39.58%)	379 (100%)
	P	29 (39.73%)	44 (60.27%)	73 (100%)
Total		258 (57.08%)	194 (42.92%)	452 (100%)

Table 4: Correlation between Wound Infection and Mortality

		Wound Infection		
		N	Y	Total
Mortality	N	257 (66.24%)	131 (33.76%)	388 (100%)
	Y	1 (1.56%)	63 (98.44%)	64 (100%)
Total		258 (57.08%)	194 (42.92%)	452 (100%)

Table 2: Correlation between HIV status and Mortality

		HIV Status		
		N	P	Total
Mortality	N	322 (82.99%)	66 (17.01%)	388 (100%)
	Y	57 (89.06%)	7 (10.94%)	64 (100%)
Total		379 (83.85%)	73 (16.15%)	452 (100%)

Table 5: Correlation between Age and Mortality

		Mortality		
		N	Y	Total
Age Range (years)	0 – 5	356 (85.37%)	61 (14.63%)	417 (100%)
	6 – 10	11 (91.67%)	1 (8.33%)	12 (100%)
	11 – 15	4 (100%)	0 (0.00%)	4 (100%)
	>16	17 (89.47%)	2 (10.53%)	19 (100%)
Total		388 (85.84%)	64 (14.16%)	452 (100%)

Table 6: Correlation between TBSA and Mortality

	Mortality		
	N	Y	Total
1 – 10	296 (99.33%)	2 (0.67%)	298 (100%)
11 – 15	73 (91.25%)	7 (8.75%)	80 (100%)
TBSA			
16 – 25	4 (100%)	0 (0.00%)	4 (100%)
>26	17 (89.47%)	2 (10.53%)	19 (100%)
Total	388 (85.84%)	64 (14.16%)	452 (100%)

Table 7: Logistics Regression of risk factors for death

	Odds Ratio	95%	C.I	P value
Age	0.97	0.86	1.10	0.64
Sex (M/F)	2.07	0.85	5.06	0.11
Hb	0.91	0.75	1.11	0.35
HIV Status (P/N)	0.59	0.16	2.19	0.43
% TBSA	1.52	1.38	1.66	<0.001

Table 8: Logistics Regression of risk factors for wound infections

	Odds Ratio	95%	C.I	P value
Age	1.03	0.99	1.07	0.09
Sex (M/F)	1.72	1.13	2.60	0.01
Hb	1.03	0.94	1.12	0.54
HIV Status (P/N)	2.47	1.42	4.29	0.001
% TBSA	1.13	1.09	1.17	<0.001

DISCUSSION

A total of 452 cases were recruited into the study and the median age was 10.5 years (Table 1). 92.3% (417) of the patients were below the age of 5 years. When this data is compared to the anecdotal UTH data collected between 1st January 2007 and 31st December 2007, it shows that the majority of burns patients admitted to UTH are below the age of 5 years.

Seventy three (16.15%) of these patients tested positive for HIV while 379 (83.85%) were HIV negative.

According to a report by AVERT, 17.5% of hospital patients in Lusaka were found to be HIV positive³. This shows that the prevalence of HIV in burns patients is essentially the same as in the general population.

Correlation between HIV Status and Mortality (see Table 2)

Of the 73 HIV positive cases in the study, 7 (9.59%) died and 66 (90.41%) were discharged. This translates into a 9.56% in hospital mortality rate. 379 patients were HIV negative with 57 (15.04%) mortalities and 322 (84.96%) discharges.

Statistical analysis using chi squares shows that this finding is not statistically significant (p = 0.221 at 95% CI) proving that HIV status of a patient does not alter the outcome of burns in terms of mortality. This is in agreement with the study at the South African University of Stellenbosch¹⁶.

Correlation between HIV Status and Burn Wound Infection (see Table 3)

A total 194 patients developed burn wound infection. Of these 44 (22.68%) were HIV positive while 150 (77.32%) patients tested negative for HIV. There was no wound infection in 29 HIV positive patients. Statistical analysis shows that this finding is statistically significant (p = 0.001 at 95% CI). This indicates that among the cases studied at UTH, the occurrence of wound infection was higher in HIV positive patients than those who are negative. The reason for this could be due to the immunosuppression which occurs in HIV infection.

The researchers at the University of Stellenbosch similarly concluded that HIV positive patients had more infections but their analysis revealed that there was no statistical difference between the two groups¹⁶. In contrast, the study at the University of Malawi showed that the occurrence of sepsis was equal among HIV positive and negative patients¹⁵.

Correlation between Wound Infection and Mortality (see Table 4)

Of the 194 patients who developed burn wound infection 63 (32.47%) died while 131 (67.53%) were discharged. Statistical analysis shows that this finding is statistically significant (p = 0.000 at 95% CI). This indicates that in patients studied at UTH with burn wound sepsis, mortality is more likely to occur than in those without sepsis.

Correlation between Age and Mortality
(see Table 5)

Sixty four of the study patients died. Of these 61 (95.31%) were below the age of 5 years. There were a total of 361 burns patients below the age of 5 years and of these 61 died. This translates into a mortality rate of 17.1%. In the 6 to 10 years age group, the mortality rate is 9.1% and 11.8% in patients above the age of 16 years. There were no mortalities in the 11 to 15 years age range. Only 4 patients in this age range were recruited into the study. Since the majority of burns patients are below the age of 5 years, this could explain the high mortality rate.

Correlation between TBSA and Mortality
(see Table 6)

Of the 64 mortalities which occurred during the study, 2 (3.12%) had TBSA burns between 1 and 10%, 7 (10.94%) had 11 – 15% burns, 38 (59.38%) had 16 – 25% and 17 (26.56%) had more than 26% burns. This shows that, patients with large TBSA burnt (above 15% in this study) are more likely to die than those with lower TBSA.

Logistic Regression Analysis
(see Tables 7 and 8)

Logistic regression analysis of risk factors for mortality shows that TBSA is a significant factor in the clinical outcome (mortality) of burns ($p = <0.001$) and this is confirmed by an odds ratio of 1.52. Odds of death increase by 1.52 for each 1% of burnt surface area. Similarly, the logistic analysis of risk factors for wound infections shows that TBSA and HIV infection are statistically significant factors ($p = <0.001$ and 0.001 respectively). The odds of wound infection increase by 1.31 for each 1% of burnt surface area and by 2.47 in HIV positive patients.

ACKNOWLEDGEMENTS

My sincere and utmost gratitude goes to the following for their contribution and support towards this Dissertation:

My supervisor Prof Odimba for the guidance and constructive criticism rendered while undertaking this study.

Dr R Zulu my co-supervisor in this study.

Dr Ben Andrews for his advice and input.

Zambia Air Force for enabling me to undertake the studies for the Master of Medicine (Surgery).

The University Teaching Hospital, Department of Surgery for allowing me to carry out this research at the institution.

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