

Burn Care at the National Orthopaedic Hospital, Enugu: A Comparison of Two 5-Year Periods: January 2012–December 2016 and January 2017–December 2021

Abstract

Background and Objectives: The survival rate of patients with burn injuries has increased remarkably owing to the advancements in burn management which has resulted in improved survival rates, shorter hospital stays and decreases in morbidity and mortality rates due to the development of fluid resuscitation protocols, improved respiratory support, infection control etc. This study compares the parameters of burn patients admitted in a tertiary hospital from January 2012 to December 2016 and January 2017 to December 2021. **Materials and Methods:** This study was at the National Orthopaedic Hospital Enugu, NOHE. It was a retrospective study of patients who presented with burn injuries to the burn unit between the period of January 2012 and December 2021. **Results:** A total of 771 cases were analysed. Three hundred and twenty-three were seen between January 2012 to December 2016, 448 were seen between January 2017 and December 2021. Flame remained the major cause of burn injuries with 62% occurring in the first 5-year period while 72% occurred in the second 5 years. Adults had more injuries from flames than children, while children had more scald injuries than adults. The highest percentage of Total Burn Surface Area (TBSA) salvaged was 79% in the first 5-year period while 86% was salvaged in the second. Mortality rate in the first and second 5-year periods were 12% and 19%, respectively. **Conclusions:** Flame burn injuries are the most common cause of burn injuries in adults and children. Mortality was lower in the first 5-year period. A higher TBSA was salvaged in the second 5-year period.

Keywords: Burn injuries, burn care, mortality, survival

Introduction

Burn injuries occur worldwide with attendant devastating effects. Burn injuries account for more than 300,000 deaths worldwide each year.^[1] Over the last few decades, the survival rate of patients with burn injuries has increased remarkably owing to the advancements in burn management which has resulted in improved survival rates, shorter hospital stays and decreases in morbidity and mortality rates due to the development of fluid resuscitation protocols, improved respiratory support, infection control, early enteral nutrition and early excision and wound closure.^[2-4] Immediate pre-hospital care, early emergency treatment with advanced life support capability and secondary transfer to a Burn Unit are other factors that have contributed to improved survival of severe burns patients.^[5] Whereas in the USA, the Lethal Area, LA50 (that is

the total burnt surface area at which 50% of the victims dies) has improved from 40% in 1940 to 90% currently,^[5,6] that cannot be said of the developing countries where the LA50 is still low^[7] and the mortality rate for major burn injuries is still high.^[8-11] Patient mortality is, however, still the primary outcome measure for burn care. The aim of this study is to compare the burn care in our centre over a two-year period.

Materials and Methods

The National Orthopaedic Hospital, Enugu, NOHE, is the main referral centre for burn injuries in the Eastern part of Nigeria. It runs a burn department with three burn units that has ten beds with an overflow capacity to 20 beds. This study is a retrospective study of patients who presented with burn injuries to the burn unit between January 2012 and December 2021. Management of burn patients in the NOHE is either on out-patient or in-patient basis.

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Criteria for admission were according to the American Burn Association [see Table 2]. All patients were initially resuscitated with either normal saline or Ringer’s lactate using the Parkland’s formula^[12] of 4mls/kilogram body weight/TBSA. Superficial were covered with either silver sulphadiazine (1%) or povidone-iodine (10%) soaked gauze until healing occurs by re-epithelisation. Most wounds of the trunk and extremities were dressed until eschars separate before the wounds were covered with split thickness skin grafts. The ICU in the center where the study was conducted does not intubate routinely due to paucity of manpower and equipment. Inhalational injuries in these centres are managed largely by the use of nebulised salbutamol alternating with heparin and intranasal oxygen. The department is well established with qualified and dedicated burn doctors and nurses. It is also a training centre for resident doctors and nurses in Burns and Plastic surgery. The department has a dedicated theatre for burn cases and is supported by other departments in the hospital like the nutrition and dietetics, medical rehabilitation and laboratory services. Admission registers and patients folders were the sources of information which included patient’s age and sex, the date of injury, mechanism of injury, parts of the body affected, percentage body surface area burnt and mortality. Data were analysed and compared between

the two 5-year periods (January 2012 to December 2016 and January 2017 to December 2021).

Results

A total of 811 patients were admitted into the burn unit of NOHE between January 2011 and December 2021. However, a total of 771 were analysed for the study following missing or incomplete records of 40 patients (17 in the first 5-year period and 23 in the second 5-year period). Three hundred and twenty-three were seen in the first 5-year period while 448 were seen in the second 5-year period. A male to female ratio of 1:0.7 was noted in the first 5-year period while it was 1:1 in the second 5-year period [Table 1]. The ages of the patients ranged from 8 weeks to 89 years in the first period and 12 weeks to 85 years in the second 5-year period with a mean age of 20.6 ± 17.3 years and 24.7 ± 19.7 years, respectively). Data from the first 5-year period shows that 148 (46%) of the patients were children with age range between 1 day and 17 years while 189 (42%) of the patients were children in the same age range in the second period. Flame constituted the largest source of burn in both periods under review (202 (62%) and 322 (72%), respectively, while scald burn from hot water constituted the next large group of 79 (24%) and 82 (18%). In both periods, adults were affected more with flame injuries and children were affected more with scald injuries. Eleven patients (0.3%) had chemical injury in the first 5-year period while only 5 patients (0.1%) had chemical burn injuries in the second 5-year period. Both in the first and second 5-year period, 0.3% of the patients had electrical burns. [Figure 1]. Time of presentation to the hospital in the first 5-year period ranged from 45 min to 3 weeks while in the second 5-year period, it ranged from 12 min to 7 weeks. The number of days spent on admission ranged from one to 300 days (median of 17 days) and one to 384 days (median of 16 days), respectively. The main cause of flame burn included stove, lantern and gas cylinder explosions. The distribution of the depth of burn injuries in the two periods are as shown in Figure 2. More patients have superficial burn injuries in both the first and second 5-year period followed by deep dermal, full thickness and

Table 1: Biodata

Sex	2012-2016		2017-2021	
	N	%	N	%
Male	190	58	225	50
Female	133	42	223	50
Total	323	100	448	100
Age				
=<17	148	46	189	42
>17	175	54	259	58
Type of burn				
Flame	202	62	322	72
Scald	79	24	82	18
Mortality				
<50% TBSA	4	11	29	34
=>50% TBSA	34	89	56	66

Table 2: Criteria for referral to a burn unit. American Burn Association (ABA)

- Partial-thickness burns greater than 10% of total body surface area in patients who are younger than 10 years or older than 50 years
- Partial-thickness burns over more than 20% of total body surface area in other age groups
- Burns that involve the face, hands, feet, genitalia, perineum, or major joints
- Third-degree burns in any age group
- Electrical burns, including lightning injury
- Chemical burns
- Inhalation injury
- Burns in patients with preexisting medical disorders that could complicate management, prolong recovery, or affect mortality rate
- Any patients with burns and concomitant trauma (such as fractures) in which the burn injury poses the greatest risk of morbidity or death
- Burn injury in children at hospitals without qualified personnel or equipment for the care of children
- Burn injury in patients who will require special social, emotional or long-term rehabilitative intervention

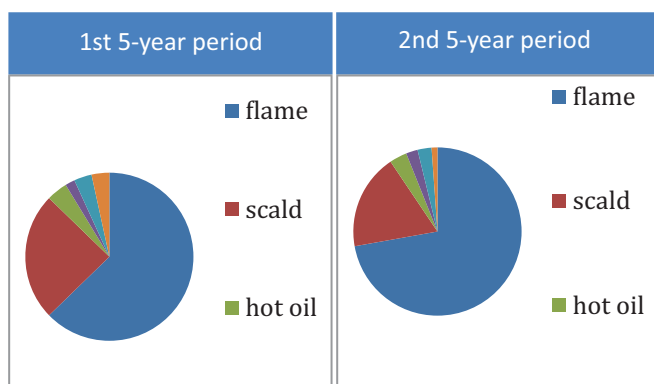


Figure 1 : Aetiology of Burns in the two 5-year period under review

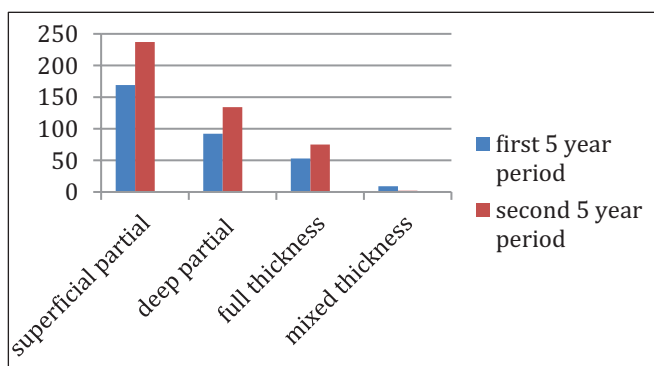


Figure 2 : Depth of burn injury

mixed thickness burn injuries. Thirty-eight patients died in the first 5-year period making it a mortality rate of 12% (with 32% having an inhalational component) while 85 patients died in the second period making it a mortality rate 19% (with 47% having an inhalational component). Thirty-four, out of the 38 patients that died in the first 5-year period had a TBSA of equal to or more than 50% while the remaining 4 had less than 50% TBSA but with no inhalational component. On the other hand, 34% of the 85 patients who died in the second period had less than 50% TBSA. It is interesting to note that, while no inhalational injury was reported in the patients who died with less than 50% TBSA in the first period, 38% of the patients who died with less than 50% TBSA in the second period under review had an inhalational component to their burn injuries. This explains why the mortality is higher in the second 5-year period. The highest percentage of TBSA that was salvaged in the first 5-year period was 79% in a 45 year old female who had mixed thickness (superficial partial thickness, deep partial thickness and full thickness) flame burn injuries who later had split thickness skin grafting and was discharged after 99 days on admission. In the second period under study, the highest percentage of TBSA salvaged was an eleven month old male child with scald burn injuries of 86% who sustained mainly superficial partial thickness burns and was discharged home after the wounds have re-epithelialised after 3 weeks of wound dressing. In the second period, a male adult with 81% mixed thickness burn injuries (superficial partial thickness and deep partial thickness)

flame injuries who later was discharged home when the wounds re-epithelialised after 33 days of wound dressing.

Partial-thickness burns greater than 10% of total body surface area in patients who are younger than 10 years or older than 50 years

Partial-thickness burns over more than 20% of total body surface area in other age groups

Burns that involve the face, hands, feet, genitalia, perineum, or major joints

Third-degree burns in any age group Electrical burns, including lightning injury

Chemical burns

Inhalation injury

Burns in patients with pre-existing medical disorders that could complicate management, prolong recovery, or affect mortality rate

Any patients with burns and concomitant trauma (such as fractures) in which the burn injury poses the greatest risk of morbidity or death

Burn injury in children at hospitals without qualified personnel or equipment for the care of children

Burn injury in patients who will require special social, emotional or long-term rehabilitative intervention

Discussion

It has been observed that in the last few decades, the survival rate of patients with burn injuries has increased remarkably. This is observed to be due to the advancements in burn management which has resulted in improved survival rates, shorter hospital stays and decreases in morbidity and mortality rates due to the development of fluid resuscitation protocols, improved respiratory support, infection control, early enteral nutrition and early excision and wound closure.^[2-4] Again, even though the unit burn protocol did not change in the two study periods, there was however an increased emphasis on its adherence in the second study period. These are likely the reasons for the improvement noted in the survival of burn patients in our Center. There is improved patient survival as seen in the survival of patients with up to 86% TBSA (in a child with scald burn injuries) and 81% TBSA (in an adult male with flame burn injuries) in the second 5 years under review which was a new milestone in patient care. The commonest cause of burn injuries in the two periods under review remained flame with scald being the commonest cause of burn injuries in children. Our literature review reveals that other authors had same findings.^[7,11,13,14] This knowledge will help in channelling preventive campaigns appropriately. Provision of fire extinguishers in homes, cars, factories and public places may go a long way in reducing the incidence of flame burns and burn injuries generally.

Table 3 : Relationship between number of days on admission and outcome of injury 2012–2016

	Discharged	DAMA	Death	Discharged on request	Referred	Total
No of days on admission						
<24 h	9(3.7 %)	4(19.0%)	6(15.8 %)	1(6.2 %)	0(0.0%)	20(6.2 %)
Within 2 weeks	81(33.3 %)	9(42.9 %)	21(55.3 %)	7(43.8 %)	0(0.0%)	118(36.5 %)
2–4 weeks	66(27.2 %)	3(14.3 %)	4(10.5 %)	3(18.8 %)	1(20.0 %)	77(23.8 %)
>1 month	87(35.8%)	5(23.8 %)	7(18.4 %)	5(31.2 %)	4(80.0 %)	108(33.4%)
Total	243(100%)	21(100 %)	38(100 %)	16(100 %)	5(100 %)	323(100%)
Variable					P value	
No of days on admission * outcome of injury					0.001	

Table 4 : Relationship between number of days on admission and outcome of injury 2017–2021

	Outcome of Injury					Total
	Discharged	DAMA	Death	Discharged on request	Referred	
No of days on admission						
<24 hours	34(11.1 %)	9(37.5 %)	20(23.5 %)	2(8.3 %)	2(22.2%)	67(15.0%)
Within 2 weeks	95(31.0 %)	6(25.0 %)	43(50.6 %)	9(37.5%)	1(11.1%)	154(34.4%)
2-4 weeks	91(29.7 %)	3(12.5 %)	10(11.8 %)	5(20.8%)	4(44.4%)	113(25.2%)
>1 month	86(28.1 %)	6(25.0 %)	12(14.1 %)	8(33.3%)	2(22.2%)	114(25.4%)
Total	306(100 %)	24(100 %)	85(100 %)	24(100%)	9(100%)	448(100%)
Variable					P value	
No of days on admission * outcome of injury					0.001	

In a study by Tyson *et al.*,^[15] they noted that most of the mortality occur in the first 10 days while authors in this study noted that most of the deaths occurred within the first 14 days in both the first and second 5-year period under review accounting for 55.3% and 50.6% of the death, respectively [Tables 3 and 4]. This means improved survival of burn injured patients who have deeper burn injuries and could have succumbed to infections without the improvement in care given by the managing team. The improvement in care was as a result of strict adherence of the burn team to aseptic technique and burn protocol. The mortality in this study was 10% and 10.7% for the first and second 5-year periods, respectively. The observed mortality rates in the two 5-year study groups are a lot of improvement when compared to the rate reported by other centres in Africa which ranges from 12% to 35%.^[11,16-21] but the mortality rate in children^[7] in both the developing and developed countries is usually less than 10%.^[22] However, worthy of note is that even though the first and second 5 year periods share almost the same rate of mortality, 10% of the deaths in the first period occurred in patients who had less than 50% TBSA. In the second period, however, no patient died from burn injuries of less than 50% TBSA. Surgeons working in burn care, especially in low and middle income countries are encouraged to domesticate the unit's burn protocol (Appendix 1) in their different centres as this helps in guiding the care given to burn patients and its use has been associated with improvement in care in our study. An area of in burn care that needs improvement is management of inhalational injuries. Many hospitals in the low and middle income countries

like ours have not developed a good system for respiratory support for patients with inhalational injuries.^[23] The lack of the expertise and equipment impacts negatively on the management of burn patients and hence increases the rate of mortality seen in these countries.

Conclusion

The incidence of burn injuries cuts across all ages and gender. It remains that flame burn injuries are the most common cause of burn injuries in adults and children. However, scald burn injuries are still commoner in children than in adults. The incidence of mortality in the first 5-year period was lower than the second 5-year period but patients with higher percentage of burn injuries were salvaged in the second period. Over the years some surgeons in the center where the study took place have introduced written protocols among other things to improve patient care which has resulted in the salvage of patients with high TBSA and increasing the LA50 in the countries. This is an ongoing process and needs support from the hospital management both locally and nationally.

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Conflicts of interest

There are no conflicts of interest.

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Appendix 1

UNIT PROTOCOL FOR BURNS MANAGEMENT

1. Review of burn surface/depth estimation should be done by the unit senior registrar within the shortest possible time.
2. Admission should be done based on the standard admission criteria.
3. Resuscitation is based on the Parkland's formula (4mls/kg/%TBSA) using Ringers Lactate or Normal Saline if the former is not available. Actual weight must be obtained.
4. For children, if need be, institute intra-osseous access pending when a cut-down is established.
5. Every patient on resuscitation should be reviewed 4h after commencement.
6. Urine output is to be maintained at 1ml/kg/hr for adults and 1.5mls/kg/hr in children.
7. Patients that are not in shock on presentation should have early commencement of oral feeds.
8. Patients in shock should commence oral feeds soon after stabilisation and return of normal bowel activity.
9. Protein requirement is to be calculated by Sutherland formula (1g/kg + 3g/BSA daily). $\frac{1}{2}$ as eggs (6–7 g protein) and $\frac{1}{2}$ as casilan (6g per serve), for example, 4 eggs thrice daily and 4 spoons of casilan/complan thrice daily.
10. 5 times the daily requirements of multivitamins (A,C,E) for major burns.
11. 10 times the daily requirements of multivitamins (for BSA > 40%).
12. Patients presenting beyond 30 mins of incident and those with history suggestive of contamination will benefit from prophylactic antibiotics (Penicillin + metronidazole).
13. Do escharotomy for circumferential deep dermal and full thickness wounds on limbs and chest wall.
14. Fasciotomy must be considered for every electrical burn.
15. Unit consultant must be informed for every intervention outside resuscitation.
16. FBC should be requested twice weekly (Monday and Thursday) and 48 h after iv antibiotics.