[Downloaded free from http://www.njotonline.org on Thursday, August 24, 2023, IP: 102.89.33.99]

Original Article

Burns Care in Sub-Saharan Africa: Experience from a Trauma Registry in Nigeria – An Observational Study

Sydney E. Ibeanusi, B. Kejeh

Department of Surgery, University of Port Harcourt, Port Harcourt, Nigeria

Abstract

Background: Burns is quite common and often associated with deleterious consequences. The incidence, mortality and morbidity from burns are decreasing in most developed countries over the years, but in the developing countries, the burden of burn injuries continue to pose a significant challenge. Various factors have been attributed to this persisting trend. This study aim is to highlight the pattern of presentation, care and outcome of injuries from burns from a regional trauma registry in Nigeria. **Methods:** Retrospective evaluation of data from a regional trauma registry in Port Harcourt Nigeria prospectively collected over a seven-year period (from January 2007 to December 2013). Descriptive and inferential statistics of the results are presented. **Results:** The result showed that 601 cases of burns were recorded during the period under observation. Males between the age group (20-29) years were the most involved ($n = 223$ {37.1%}) and flame burns ($n = 380$ {63.2%}) arising mainly from explosions of petroleum products ($n = 333$ {55.4%}) was the most commonly seen. The overall mortality recorded was 34%, but the median lethal burn surface area at which 50% of the victims died was about 40%. Most of the deaths occurred in the first week following burns. The common early complications were fluid and electrolyte derangement ($n = 280$ {46.6%}), while burn scarring was a common complication among survivors. **Conclusion:** Burns remains a significant contributor to high trauma mortality and morbidity in the region. Inadequate infrastructure, human and material resources and some persisting cultural beliefs and practises contribute to the poor outcome of burns.

Keywords: Burns care, epidemiology of burns, Nigeria, outcome, sub-Saharan Africa

Introduction

Burn injury has a global distribution and contributes to trauma mortality and morbidity.[1-3] There has been a progressive decline in admissions and deaths resulting from burn injuries in developed countries such as the US and Western Europe[3,4] attributable to improved preventive measures, improved resuscitation and critical care, and better management of burn wounds.[5,6]

The LA50 for burns which is the total burn surface area (TBSA) at which 50% of victims died, of 98% has been reported in children in the US.[7,8] However, in most developing countries including Nigeria, the mortality and morbidity arising from burn injuries remain high with many studies in the region reporting LA50 in the range of 30%–35%.[2,9-12]

The reported poor outcomes in sub-Saharan Africa have been attributed to lack of pre-hospital care, delay in presentation to hospital, unorganised approach to initial and later burns to care in the region and lack of human and material resources.[13-15] Poverty and ignorance contribute to a great extent the outcome of burns in the region as many of the victims and their families are often not able to afford the care for burns even when such treatment is available.[13,14] Furthermore, some persisting cultural beliefs and traditional practices such as pouring raw egg on burn wounds, application of common salt on burnt skin, application of saps from special trees and vegetables on burn wounds, application of palm kernel oil and petroleum-based engine oils and lubricants on burnt surfaces influence the outcome.[16-18] Cases of 'Deliberate burns', especially in children as a treatment for febrile convulsion and other conditions had been reported incidentally from the same city with the current study.[19]

Access this article online

Quick Response Code:

Website: www.njotonline.org

DOI: 10.4103/njot.njot_8_18

Address for correspondence: Dr. Sydney E. Ibeanusi, Department of Surgery, University of Port Harcourt Teaching Hospital, Port Harcourt, Nigeria.
E-mail: sydney_ibe@hotmail.com

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: reprints@medknow.com

How to cite this article: Ibeanusi SE, Kejeh B. Burns care in Sub-Saharan Africa: Experience from a trauma registry in Nigeria – An observational study. Niger J Orthop Trauma 2018;17:29-33.

[Downloaded free from http://www.njotonline.org on Thursday, August 24, 2023, IP: 102.89.33.99]

Some worrisome trends in the pattern of burns in Nigeria, especially in the Niger Delta region, in the recent time, is the prevalence of flame burns arising from burn disasters from explosions from petroleum pipeline vandalisation, crashes involving petroleum-laden trucks and the use of contaminated petroleum products, especially kerosene which appear to have persisted in the region.[20-25] Burns resulting from such practices are often severe and usually involve multiple casualties and sometimes the whole family when it occurs in the domestic setting.[22,23]

This study aims to highlight the pattern of presentation, care and outcome of injuries from burns from a regional trauma registry in Port Harcourt, Nigeria.

Methods

Retrospective evaluation of data of burn injuries from an on-going regional trauma registry prospectively collected involving different hospitals in Port Harcourt, Nigeria between January 2007 and December 2013 was undertaken. The study was approved by the Management and the Ethical Review Committee of the International Centre for Advanced Medical Care and Development who are the developers of the registry. Since this study was designed as an observational survey without direct intervention or interaction with the patients, waiver for informed consent from the patients was obtained. However, the patients' identity remained confidential throughout the study. Data of burns subset were extracted from the registry and analysed to establish the demographic pattern, pattern of presentation of burn injuries, treatment offered and outcome.

Data were managed and analysed using IBM SPSS Statistics for Windows Version 20.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics are presented as proportions and percentages as well as by the use of appropriate scientific figures. Chi-square was used to test for statistical significance for observed differences for categorical variables and association between mortality and TBSA was determined with correlation analysis as considered appropriate. Values of $P < 0.05$ were accepted as statistically significant.

Results

During the 7-year period under evaluation, a total of 601 cases of burns were recorded. There were 390 males (64.9%) and 211 females (35.1%) giving a male-to-female ratio of 1.9:1. The age distribution showed that the modal age group for burns was (20–29) years, $n = 223$ (37.1%), closely followed by persons aged between 30 years and 39 years $n = 158$, (26.3%). Children, <10 years made up 18% ($n = 108$) of the cases while persons older than 50 years were 2.7% ($n = 16$). The mean age of the patients was 26.8 ± 22.8 years [Figure 1].

The most prevalent cause of burns among observed patients was petroleum products explosions in domestic settings, at workplaces, following crashes with secondary fire outbreak and from improper handling of petroleum products ($n = 333$, [55.4%]), burns following motor vehicular crashes contributed 8.3% of the cases ($n = 50$) [Table 1].

Flame burns were the most common type recorded ($n = 381$ [63.4%]) followed by scalds ($n = 90$ [16.0%]), whereas 150 persons (19.9%) had associated inhalational burns [Table 2].

One hundred and fifty patients (25%) had associated inhalational burns.

The TBSA of the body was calculated using the Wallace rule of Nines[26] for adult patients and in some instances, the Lund and Browder Chart[27] for the paediatric patients. One hundred and eighty-eight patients (31.3%) had minor

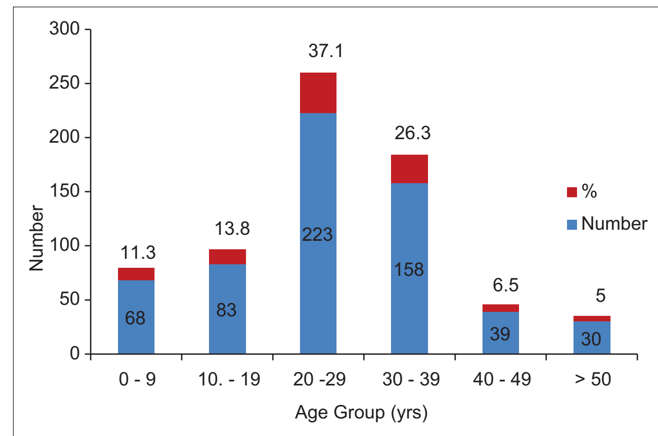

Figure 1: Age distribution of patients with burns

Table 1: Cause of burns

Cause	Frequency (%)
Petroleum product explosions	333 (55.3)
Petroleum tanker/pipeline explosions	268 (44.6)
Domestic explosions	50 (8.3)
Workplace explosions	15 (2.5)
Road traffic crashes	50 (8.3)
Other domestic accidents	80 (13.3)
Industrial accidents	16 (2.7)
Falls with friction burns	10 (1.7)
Assault/arson	20 (3.4)
Others	42 (7.0)
Total	601 (100)

χ^2=529.883; P<0.0001

Table 2: Types of burns

Type	Frequency (%)
Flame	381 (63.4)
Scald	90 (15.0)
Frictional burns	48 (8.0)
Contact burns	32 (5.3)
Electric burns	30 (5.0)
Chemical burns	20 (3.3)
Total	601 (100)

χ^2=725.216; P<0.001

[Downloaded free from http://www.njotonline.org on Thursday, August 24, 2023, IP: 102.89.33.99]

burns with TBSA <10% while more than half of the patients (*n* = 316 [53.6%]) had severe burns with TBSA higher than 20%.

The median interval to presentation from the time of the incident was 2 h with the range between 5 min and 2 weeks. It was observed that all the patients with burns were resuscitated using the Parklands formula while burn wounds were treated with repeated wound dressings followed by delayed split-skin grafting (SSG) after separation of the burn eschar for some of the patients. None of the patients had early wound excision and skin grafting. The median duration of hospitalisation of survivors was 19 days (range = [1–374] days, inter-quartile range [IQR] = 22 days) while median duration of hospitalisation for the patients that died was 8 days (range = [1–192] days, IQR = 10.5 days). The mean duration of hospitalisation for survivors was 15 days ± 22 days while that for the dead patients 6 days ± 9 days [Table 3].

The common early complications observed included, fluid and electrolyte derangements (*n* = 280 [46.6%]), sepsis (*n* = 240 [39.9%]), multiple organ failure (*n* = 154 [25.6%]) while late complications among survivors included abnormal scarring (*n* = 189 [31.4%]) and contractures (*n* = 85 [14.1%]), [Tables 4].

The overall crude mortality was 33.9% (*n* = 204), and the case fatality showed that all the patients with burns over 60% TBSA died. The calculated LA50 was approximately 42% [Table 5].

Table 3: Duration of hospitalisation (length of stay)

Length of hospitalisation	Survived patients	Dead patients
Median LOS (days)	8	191
Range (days)	191 (1-192)	373 (1-374)
Inter-quartile range (days)	10.5	22

LOS: Length of stay

Table 4: Complications of burns

Complications	Frequency (%)
Fluid and electrolyte derangement	280 (46.6)
Sepsis	240 (39.9)
Multiple organ dysfunction/failures	154 (25.6)
Amputation	23 (3.8)
Abnormal scarring	184 (31.4)
Contractures	81 (14.1)

Some patients had multiple complications

Table 5: Relationships between percentage total burn surface area and mortality

Percentage TBSA	Numbers of patients	Mortality (%)
<10	188	3 (1.6)
10-20	97	13 (13.4)
21-30	101	15 (14.9)
31-40	67	33 (49.2)
41-50	36	30 (83.3)
51-60	28	26 (92.9)
61-70	32	32 (100)
71-80	24	24 (100)
81-90	18	18 (100)
91-100	10	10 (100)
Total	601	204 (33.9)

Spearman's correlation R=0.9692, P<0.0001, LA50 = 42%. TBSA: Total burn surface area

Discussion

It is well known that most deaths (95%) related to fire burns occur in developing countries with Africa contributing up to 25% of such numbers.[21] This study also showed that the young adult males who usually are the breadwinner of the family and economic livewire of the nation were the most commonly affected. The findings of this study corroborated the results from other studies[10,12] but showed a shift from an earlier trend in the distribution of burns reported in the same region about two and a half decades ago which showed children <10 years to be the most affected.[9] Studies from various parts of sub-Saharan Africa confirm this changing trend[2,28] in the pattern of burns distribution. The rising trend of flame burns may not be unconnected to the frequent petroleum product explosions resulting from improper handling of such products, increasing the incidence of petroleum pipeline vandalisation, especially in the Niger Delta where this study was undertaken and adulteration of domestic kerosene which often has been fingered in the aetiology of kerosene stove explosions.[24,25] In one of the cases of burn disaster and mass casualty over 250 persons were involved of which about 225 persons died from a community attempting to fetch petroleum product from a fallen truck *r* laden with the premium motor spirit in Rivers State, Nigeria where this study was undertaken. Such occurrences are now becoming frequent.

This observed predominance of flame burns over scald in this study (P < 0.001) may have been due to the increasing frequency of petroleum products explosions. Whereas burns from scald remain a significant problem among children <10 years, several episodes of explosion resulting in burn mass casualties in Nigeria involving children and young adults have been recorded,[29,30] especially when such incidents occur in domestic settings. The continuing public power failure and recurrent scarcity of petroleum products encourage families to store petroleum products inappropriately at home and workplaces, which increase the hazard of burns at homes and workplaces. Other forms of petroleum product explosions often follow petroleum pipeline vandalisation, misadventure from burst petroleum pipelines, explosions from overturned trucks laden with petroleum products and the use of adulterated petroleum products such as domestic kerosene for domestic purposes.[29,30] The adulteration of such petroleum products often with lighter products, alter the flashpoints of the product and lower the ignition points.[31] A report from Calabar, another urban city in the Niger Delta of Nigeria, confirmed that 81.3%, (*n* = 48) of the burn cases were flame burns mainly from petrol and kerosene explosions.[25] Some

[Downloaded free from http://www.njotonline.org on Thursday, August 24, 2023, IP: 102.89.33.99]

authors have attributed the tendency to adulterate petroleum product or vandalise petroleum product pipelines to poverty, criminality and sheer greed of some unscrupulous persons.[22,23]

The perennial failure in the public power supply in the country and recurrent scarcity of petroleum products has led to the proliferation of electricity generating sets at homes and business premises and encourages families to store such petroleum products in odd places thus increasing the hazard of burns at homes and business premises. This practice often led to domestic fire outbreaks and a higher risk of burn injury.[30] Occasional misadventures from accidental burn disasters involving trucks laden with petroleum products have been recorded from various parts of sub-Saharan Africa including Nigeria.[14,15,30-32] Cases of fully loaded commuter buses going up in flames following collision had been recorded.[33]

A good number of the patients presented with severe burns with TBSA >20% and about 20% of the patients had associated inhalational burns. These patterns are often related to the aetiology which is mainly from explosions of petroleum products resulting in flame burns with an associated inhalational injury, especially when the incident occurred in enclosed spaces such as in domestic settings.[15,22] Agbenorku *et al*. had earlier shown that about 90% of patients from petroleum-related fire disaster had burned with TBSA higher than 30%.[15] Other studies from other parts of Nigeria also confirm this pattern.[2,22]

Despite poorly organised pre-hospital care in the country, most of the patients with severe burns arrived early (within 8 h of injury) to the hospital. Similar findings had been reported by other authors in various studies from in the country and other parts of sub-Saharan Africa.[2,14] This pattern of response may be attributable to the public perception of burns in the region especially when extensive as a devastating injury with the often poor outcome.

Most of the patients in this study were treated using conservative methods with fluid resuscitation, repeated wound dressing until the burn eschar separated from the wound bed when delayed SSG was done. None of the patients had early wound excision and wound cover which has been attributed as one of the reasons for improved survival from burns in the developed countries.[3,5] The none-excision is a common practice reported in other studies on burn injury in the region.[9,10,12] This practice has been attributed to the lack of skin substitutes required to cover the wound after early wound excision.[10,12] Since the new skin substitutes are readily not affordable by the majority of the patients, active intervention by various tiers of government organised private sector and well-meaning individuals by way of support to fund burn care may help to improve the outcome of burn injuries in the region. Enhanced availability of some of the material required for optimal burn care will undoubtedly enhance the result of burns in the region. Improved availability of materials and broader coverage of the universal health insurance in the country will positively impact on the outcome of burns.

The observed median duration of hospitalisation of 8 days among the patients that died suggests that a good number of these patients with significant burns may have died from complications of inadequate resuscitation, either under resuscitation or over resuscitation and limited intensive care during the early phase of burns[12] or as a result of the severity of the burn injury. Other studies show that most deaths from burns in sub-Saharan Africa follow similar trends as most trauma deaths in the region.[34] The 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 failures'.[35] Be that as it may, the extents of injuries following petroleum product explosions are often much and usually non-survivable, especially in the face of limited resources for burn care.

The observed crude mortality from this study (33.9%) is similar to that reported by other studies across Nigeria and sub-Saharan Africa.[2,9-11] However, the case fatality pattern showed significant mortality in patients with burns with TBSA higher than 30% ($P < 0.05$) with a strong correlation between the TBSA and the case fatality ($\rho = 0.969$). In fact, almost all the patients with TBSA >50% died with the LA50 approximated to 42%. This finding was similar to an earlier report in the same city about two and a half decade from this period under study where the majority of the patients with burns over 50% died.[9] The use of crude mortality to access the quality of burn care of a system may be misleading as such benchmark may not account for the diversity in the severity of burn injuries. The adoption of LA50 in this study ensured that a standard criterion was used to benchmark outcome. Such criterion allows for comparison between centres, regions and systems.

The observed crude mortality in this study is similar to but slightly improved results earlier reported from various other centres in Nigeria i.e., Enugu,[12] Lagos[10] Irrua,[36] Zaria,[2] Ghana,[15] Cote d'Ivoire[29] and India[37] with the LA50 reported from these studies still in the region of 30%. This range is similar to the figure observed in most developed countries in the seventies,[5] and a far cry from the figures presently reported from most developed countries.[2,3,5,9] In the study from Enugu, Olaitan and Jiburum recorded crude mortality of 20%, $n = 57$ with about 93% of the deaths arising from flame burns. The decline in the mortality from burns observed in the developed countries have been attributed to the promulgation of effective prevention programmes,[38] advances in pre-hospital care and improvements in early burns and intensive care in well-equipped burn centres.[35] Other reasons include early excision of burn wound and wound cover and use of newer skin substitutes.[5] Besides, because of rapid intervention in the rescue and treatment of burn victims in most developed nations, the severity of burns in such climes are often not as severe as those in the developing countries. This influences the outcome of treatment.

The common complications recorded in this study included fluid and electrolyte imbalance ($n = 280$), sepsis ($n = 240$), multiple organ dysfunctions and failure ($n = 154$) which contributed to the recorded mortality. These complications were direct

[Downloaded free from http://www.njotonline.org on Thursday, August 24, 2023, IP: 102.89.33.99]

and indirect consequences of inadequate resuscitation and improper wound care which also contributed to the prolonged hospitalisation observed among survivors with less severe burns. Other complications observed among survivors included wound contractures ($n = 184$), scars and loss of function ($n = 81$) which is a reflection of the quality of care initial survivors of burn receive in the region. Improvements in the quality of burn wound care have been shown to reduce these complications.[5,35]

Conclusion

Burns are still a common problem in Port Harcourt, Nigeria and contribute significantly to mortality and morbidity arising from trauma in the region. Whereas there is a changing pattern in the aetiology, severity and the distribution of burn injuries seen in the region, the outcome of burns in the region has not improved remarkably over the period. In the presence of limited human and material resources required for optimal care for burns, prevention programmes for burns may be the pragmatic approach to reducing the mortality and morbidity arising from burns in the region. Emphases should also be directed at training various levels of medical and support personnel in modern burns care, and provision of appropriate funding of centres capable of providing quality burns care.

Acknowledgements

We acknowledge the Board and Management of International Centre for Advanced Medical Care and Development for allowing us access to the data from their trauma registry.

We also acknowledge the role of Prof. E. Obiechina in proofreading the article.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Olaitan PB, Olaitan JO. Burns and scalds – Epidemiology and prevention in a developing country. Niger J Med 2005;14:9-16.
2. Kalayi GD. Mortality from burns in Zaria: An experience in a developing economy. East Afr Med J 2006;83:461-5.
3. Haik J, Liran A, Tessone A, Givon A, Orenstein A, Peleg K, *et al.* Burns in Israel: Demographic, etiologic and clinical trends, 1997-2003. Isr Med Assoc J 2007;9:659-62.
4. Brigham PA, McLoughlin E. Burn incidence and medical care use in the United States: Estimates, trends, and data sources. J Burn Care Rehabil 1996;17:95-107.
5. Heimbach D. Burn patients, then and now. Burns 1999;25:1-2.
6. Vehmeyer-Heeman M, Van Holder C, Nieman F, Van den Kerckhove E, Boeckx W. Predictors of mortality: A comparison between two burn wound treatment policies. Burns 2007;33:167-72.
7. Herndon DN, Gore D, Cole M, Desai MH, Linares H, Abston S, *et al.* Determinants of mortality in pediatric patients with greater than 70% full-thickness total body surface area thermal injury treated by early total excision and grafting. J Trauma 1987;27:208-12.
8. Lawton G, Dheansa B. The management of major burns – A surgical perspective. Curr Anaesth Crit Care 2008;30:1-7.
9. Datubo-Brown DD, Kejeh BM. Burn injuries in port Harcourt, Nigeria. Burns 1989;15:152-4.
10. Oladele AO, Olabanji JK. Burns in Nigeria: A review. Ann Burns Fire Disasters 2010;23:120-7.
11. Kalayi GD. Mortality from burns in Zaria: An experience in a developing economy. East Afr Med J 2006;83:461-4.
12. Olaitan PB, Jiburum BC. Analysis of burn mortality in a burns centre. Ann Burns Fire Disasters 2006;19:59-62.
13. Opaluwa AS, Orkar SK. Emphasise burns prevention in developing countries. BMJ 2004;329:801.
14. Agbenorku P. Morbidity and mortality data-Kumasi: 1st Ghana Burn Conference 2008/Launch of Ghana Burn Association. Theme: Prevention and Management of Burns in Ghana: Are we Doing it Right? Accra, Ghana: Ghana College of Physicians and Surgeons; July, 2008.
15. Agbenorku P, Akpaloo J, Farhat BF, Hoyte-Williams PE, Yorke J, Agbenorku M, *et al.* Burn disasters in the middle belt of Ghana from 2007 to 2008 and their consequences. Burns 2010;36:1309-15.
16. Okoro PE, Igwe PO, Ukachukwu AK. Childhood burns in South Eastern Nigeria. Afr J Paediatr Surg 2009;6:24-7.
17. Atiyeh B, Masellis A, Conte C. Optimizing burn treatment in developing low-and middle-income countries with limited health care resources (Part 2). Ann Burns Fire Disasters 2009;22:189-95.
18. Forjuoh SN. Burns in low- and middle-income countries: A review of available literature on descriptive epidemiology, risk factors, treatment, and prevention. Burns 2006;32:529-37.
19. Datubo-Brown DD. Deliberate burns in Nigerians. Trop Doct 1989;19:137-40.
20. Ahuja RB, Bhattacharya S. Burns in the developing world and burn disasters. BMJ 2004;329:447-9.
21. World Health Organization. The Injury Chart Book: A Graphical Overview of the Global Burden of Injuries. Dept of Injuries and Violence Prevention + Non-Communicable Diseases and Mental Health Cluster. Geneva: World Health Organization; 2002.
22. Oduwole EO, Odusanya OO, Sani AO, Fadeyibi A. Contaminated kerosene burns disasters in Lagos, Nigeria. Ann Burns Fire Disasters 2003;16:208-12.
23. Olugbenga SA. Adulterated kerosene burn disaster: The Nigeria experience. Ann Burns Fire Disasters 2005;18:34-40.
24. Olugbenga SA. Adulterated kerosene burn disaster: The Nigeria experience. Ann Burns Fire Disasters 2005;18:40-4.
25. Asuquo ME, Ekpo R, Ngim O, Agbor C. A prospective study of burn trauma in adults at the university of Calabar teaching hospital, Calabar (South Eastern Nigeria). Eplasty 2008;8:e36.
26. Baxter CR, Shires T. Physiological response to crystalloid resuscitation of severe burns. Ann N Y Acad Sci 1968;150:874-94.
27. Hettiaratchy S, Papini R. Initial management of a major burn: II – Assessment and resuscitation. BMJ 2004;329:101-3.
28. Vilasco B, Bondurand A. Burns in Abidjan, cote D'lvoire. Bums 1995;21:291-6.
29. Momoh MI, Okugbo SU, Ohanaka EC, Ugbeye ME. Causes and risk factors in burns; experience from Benin city. Niger J Surg Sci 2000;10:103-11.
30. Nwachukwu C, Adeyemi K, Oke B, Adetayo O, Obasola K. Past pipeline explosions. The Punch; 17 September, 2006. p. 1-2.
31. Ohiomogbe H. Kerosene Deaths. Available from: http://www.nigerdeltacongress.com. [Last accessed on 2014 May 26].
32. Jeanine C. UN Office for the Coordination of Humanitarian Affairs. OCHA Situation Report no. 1. Kenya: Fire; 2 February, 2009.
33. Federal Road Safety Corps. 2015 Report. Abuja: FRSC; 2016.
34. Wolf SE, Herndon DN. Burns. In: Townsend CM, editor. Sabiston Textbook of Surgery. 20th ed. St. Louis: W.B. Saunders; 2016.
35. Van Der Merwe E. Burn patients in Africa die of shock or sepsis. Crit Care 2008;26:428-30.
36. Dongo AE, Irekpita EE, Oseghale LO, Ogbebor CE, Iyamu CE, Onuminya JE, *et al.* A five-year review of burn injuries in Irrua. BMC Health Serv Res 2007;7:171.
37. Bariar LM, Vasenwala SM, Malik A, Ansari GH, Chowdhury TE. A clinicopathological study of infections in burn patients and importance of biopsy. J Indian Med Assoc 1997;95:573-5.
38. Song C, Chua A. Epidemiology of burn injuries in Singapore from 1997 to 2003. Burns 2005;31 Suppl 1:S18-26.