A NEW ERA IN THE MANAGEMENT OF BURNS TRAUMA IN KUMASI, GHANA

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SUMMARY. The aim of the study was to investigate the factors affecting the outcome of treatment of burns patients admitted to the Burns Intensive Care Unit (BICU) of the Komfo Anokye Teaching Hospital, Kumasi, Ghana. Information on patients admitted to the BICU from February 2001 to January 2006 was recorded. Parameters recorded included: admission record and demographics, causes of the injury, burned surface area, laboratory investigations, treatment regime, and record of discharge/death. The data were analysed with SPSS version 12.0 and Spearman's rank correlation. A total of 826 patients were recorded; males (n = 492, 60%) outnumbered females (n= 334, 40%). The mean age was 10.5 ± 5 yr, the majority (n = 441, 53%) in the range 0-10 yr. Flame burns (n = 587, 71%), scalds (n = 209, 25%), and chemicals (n = 19, 2%) were the three significant causes of burn injuries. The mean range of the total body surface area (TBSA) burned was 11-20%; 94% (n = 775) had up to 60% TBSA; 64% (n = 527) had only wound dressings for treatment; 21% (n = 174) had early excision with skin grafting, while 15% (n = 125) had delayed excision with skin grafting. The majority (n = 563, 68%) of the patients stayed for less than 10 days after admission. The mortality rate fell over the years, decreasing drastically between 2001 (20.4%) and 2002 (8.6%) and remaining at single digit level in 2003 (7.6%), 2004 (7.9%), and 2005 (7.4 %). The factors affecting the mortality trends were proper case management, increases in the number of professional medical personnel, and their greater dedication.

Keywords: burns intensive care unit, burns trauma, mortality, total burned surface area, early surgical intervention

Introduction

Burns are a major cause of death and disability and are associated with significant national healthcare resource utilization. Burns often require long periods of rehabilitation, multiple skin grafts, and extensive physical therapy. Not only can burn-related injuries leave patients with lifelong physical disabilities but burns can also result in severe psychological and emotional distress due to scarring, which often also result in significant burdens for the patients' families and caregivers. A burn is a type of injury to the skin (and deeper structures) caused by heat, electricity, chemicals, or radiation (an example of this is sunburn).[1] Burns are highly variable in terms of the tissue affected, severity, and resultant complications. Muscle, bone, blood vessels, and dermal and epidermal tissue can all be damaged with subsequent pain due to profound injury to nerves. Depending on the location affected and the degree of severity, a burn victim may experience a wide number of potentially fatal complications including shock, infection, electrolyte imbalance, and respiratory distress.[1]

Burns are associated with relatively high mortality and morbidity worldwide, especially in the developing countries.[2,3] Globally, burn injuries are responsible for about 265,000 deaths annually.[4] Over 90% of these fatalities occur in the developing countries, with south-east Asia alone accounting for over half of fire-related deaths.[5,6] There are approximately 1500 severe burns cases in Ghana annually and a sizeable fraction of these burns occur in large-scale disasters caused by petrol-related fires.[7]

Burns management in the developing countries encounters huge problems at any stage.[8] Inadequate access to burn care facilities and a poorly-equipped health care system hinder optimal treatment.[9] With no formal infection control policy in most low- and middle-income country burns units and limited aseptic techniques for wound care management, due to nursing constraints and inadequate facilities, high rates of burns-related mortality and morbidity are still seen in the developing countries.[10]

Local burn wound management is one of the most im-

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portant aspects of burns therapy after the shock phase. Several methods of burn wound management are available today.[11] Conventional dressings necessitated topical antimicrobial ointments and creams that might be expensive or unavailable and require frequent dressing changes.[11] In the developing countries with a fairly large incidence of burns and financial constraints and limited budgets, where all medical resources are stretched beyond practical limits, a major factor that must be considered is how to reduce the cost of therapy and achieve cost-effective management.[11,12]

Increasingly aggressive surgical approaches with early tangential excision and wound closure are nowadays standard practice in burn units and probably represent the most significant change in recent years, leading to improved burn victim mortality rates at a substantially lower cost.[13-19] Early excision of burned skin was first advocated for small to moderate burns.[14] Subsequently, tangential excision in repeated but frequent interventions and immediate skin cover with skin auto- or homografts were recommended for large burns.[14] By shortening hospital stay, early burn wound closure reduces infective complications. Faster healing decreases the severity of hypertrophic scarring, joint contractures, and stiffness and promotes quicker rehabilitation.[13,14] However, lack of education in general and of health education, in particular amongst the general population people in the developing countries can hinder acceptance of this procedure, and a lack of well-trained and motivated burns surgeons can further worsen the situation.[19]

If proper facilities are lacking, if blood and other resources such as dressings are not available, and if health care providers are inadequately trained and prepared, such aggressive therapy in burn victims may induce further trauma and result in a less than optimal outcome.[10,13] Moreover, without adequate skin cover with autografts, homografts, or other substitutes, the early excision of burned tissue is of no value.[10,14] "Delayed primary" is the second best alternative to "early" burn wound excision and closure, with similar advantages of reducing the risk of septicaemia, mortality, morbidity, hospital stay, and cost of treatment.[14]

Pain management, particularly in children, is another factor that divides the developed from the developing world. Provision of pain relief in the face of limited resources and, if available, a limited spectrum of analgesics, as well as inadequately trained staff, are a challenge. Any attempt to apply similar standards to those used in sophisticated units is fraught with difficulty. Illiteracy, malnutrition, poor cognitive development, differing coping strategies, and pharmacogenetic, cultural, and language differences all add to the complexity of the problem.[20] Complex techniques that offer the most benefit are seldom available to children in the developing world as they require a minimum standard of monitoring and regular reassessment to allow individualized titration of analgesia, the final choice of which is unfortunately dictated by economic pressure or by the facilities available rather than by what would be considered best for a burned child.[20]

The management of burns at the Komfo Anokye Teaching Hospital, Kumasi, has set off on a new trend since the establishment of a new burns ward with a capacity of only 7 beds. The ward was initially meant for acute and severely burned patients, hence, the name Burns Intensive Care Unit (BICU). Over the five-year period between its inception on 1 February 2001 and 31 January 2006, the BICU managed cases of various degree and severity. This study investigates the factors affecting the outcome of treatment of the patients admitted to KATH-BICU within that period.

Materials and methods

Data collection and analysis

This prospective study was carried out from 1 February 2001 to 31 January 2006. The parameters of all burn patients admitted to the BICU were entered into a computer database: record of admission, sex, age, causes of injury, body surface area (BSA) burned, and the patients' treatment regime, i.e. wound dressings, early tangential burned wound excision/delayed excision with split-thickness skin grafting, antibiotic regime, and record of discharge/death. The patients also did various laboratory tests (haemoglobin levels, electrolytes, kidney and liver function, wound swabs for culture and sensitivity tests. This information was analysed with SPSS version 12.0 (SPSS, Inc., Chicago, IL, USA) and Spearman's rank correlation.

Treatment centre

The Komfo Anokye Teaching Hospital (KATH) in Kumasi, Ghana, is the second-largest hospital in the country and the only tertiary health institution in the middle belt of the country. It is the main referral hospital for the Ashanti, Brong Ahafo, Northern, Upper East, and Upper West Regions.

The hospital was built in 1954 as the Kumasi Central Hospital. It was later named Komfo Anokye Hospital after a legendary fetish priest of the Ashantis. It was converted into a teaching hospital in 1975, affiliated to the School of Medical Sciences of the Kwame Nkrumah University of Science and Technology, Kumasi. The hospital is also accredited for postgraduate training in various surgical and medical disciplines by the West African College of Surgeons, the West African College of Physicians, and the Ghana College of Physicians and Surgeons. The hospital currently has 1000 beds - up from the initial 500 when first built.

The Reconstructive Plastic Surgery and Burns Unit, which includes the BICU, is among the units of the Surgery Directorate having state-of-the-art equipment in KATH.

The BICU admits burn patients who require critical intensive treatment and fresh burn patients with minor to medium burns.

Staffing, training, and work commitment

The BICU, having started with only one consultant plastic surgeon, a few general nurses, and auxiliary nursing staff grew steadily with staffing. More general nurses were added by the hospital administration, of whom six were sponsored by a Scottish NGO - the International Reconstructive Plastic Surgery (Ghana) Project - to receive training in renowned plastic surgery centres in Dundee and Glasgow, Scotland. Also, during this period, surgical residents were obliged to rotate in the unit, and all performed their duties diligently and with the highest commitment. Several training workshops and seminars were organized by the consultant-in-charge of the unit, who had himself attended several such international meetings locally and abroad. The burns management team was also joined by a clinical pharmacy team, who together with the physiotherapists and nutritionists all conducted combined weekly grand ward rounds. The team was later joined by two more consultants who with their vibrant dynamism brought further success to the unit.

Education on burn injuries

The medical and nursing staffs were charged with the task of educating burns patients and their carers (relatives) in relation to the prevention and immediate first-aid management of burns. They were also encouraged to educate other relatives and friends, for the rapid dissemination of information related to burns. Educational programmes on burn injury prevention were organized in schools, churches, and community halls in the Kumasi metropolis to alert the public to the common causes of prevention and the immediate first-aid management of burn injuries.

Burns treatment protocol

Surgery and wound dressing

- *Surgery.* All patients were assessed for anaesthesia immediately after they were admitted. Those who were fit for early tangential excision and split-thickness skin grafting of the burn were operated on either the same or the following day, i.e. within 48 h. "Delayed" surgery was normally performed within five to seven days (in a few cases within two weeks). However, the majority of the patients had no surgery but only wound dressings.
- *Wound dressing.* Wound dressings were applied with normal saline and covered with Vaseline gauze dressing; foam was then applied and crepe-bandaged. Fifty-six patients (6.3%) had face burns treated with open wound dressings and Dermazine cream; four of these reacted to this cream, which was therefore suspended, their wounds eventually healing after daily dressings with normal saline and the application of Vaseline.

Antibiotics and pain management

All patients had fluid replacement therapy according to the Parkland formula regime: 4 multiplied by percentage BSA burned multiplied by body weight (kg) in ml per 24 h with Ringer's lactate. BSA was calculated using the Lund and Browder chart. All patients received antibiotics, predominantly i.v. ceftazidime (Fortum), 100-150 mg per kg body weight per day (up to 9 g per day), which is effective for both Gram negative and positive rods.

Pain-relieving regimes were also instituted for all patients: i.v. morphine 0.1 mg/kg or oral syrup as morphine sulphate, 10 mg per kg body weight. Diclofenac injections, 1 mg per kg body weight were given in less severe cases, while in very severe cases i.v. pethidine was given (1 mg per kg body weight every 6 h). Paracetamol suppositories were used for children. To prevent Curling ulcers, omeprazole 20 mg was administered daily for at least two weeks.

Nutrition and physiotherapy

The nutritional status of the patients was also checked by the nutritionists on the management team; food supplements were given where necessary.

Splinting and the positioning of body parts were checked by the ward nurses and relatives, with advice from the physiotherapists on the team, who also carried out daily physical therapy interventions in order to prevent complications such as muscle atrophy and joint contractures.

Other factors

Patients were monitored for other signs and symptoms, e.g. malaria, hypostatic pneumonia, and urinary tract infections, and treated accordingly.

Laboratory investigations

Electrolytes were checked regularly and any deficiencies corrected accordingly. Kidney function was also checked regularly, mainly with regard to urine output (urea, creatinine, and creatinine clearance). Haemoglobin was checked regularly and deficiencies were corrected with fresh blood and/or fresh frozen plasma; all patients were however put on haematinics. On day 5 after admission, wound swabs for culture and sensitivity were taken and the antibiotic regime changed or continued accordingly.

Results

Demographic characteristics

The total number of patients in the study was 826, with males (n = 492, 60%) outnumbering females (n =

334, 40%) in the ratio of 3:2. The mean age of the subjects was 10.5 ± 5.0 yr, the majority (n = 441, 53%) in the 0-10 yr age group (*Figs. 1, 2*). The mean range of the total body surface area (TBSA) burned was 11-20%; 94% (n = 775) had up to 60% TBSA (*Table I*).

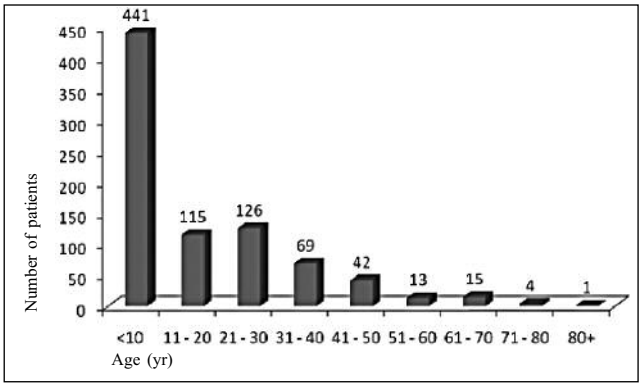

Fig. 1 - Age distribution of patients admitted to the Komfo Anokye Teaching Hospital Burns Intensive Care Unit.

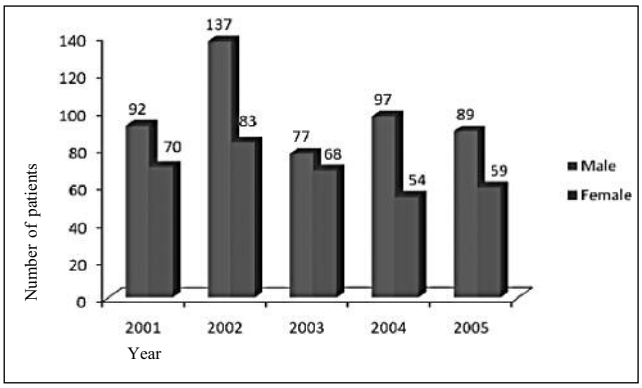

Fig. 2 - Sex distribution of patients in the various years.

Aetiology of the burn injuries

As shown in *Fig. 3*, the commonest cause of burn injuries was flame burns (n = 587, 71%) followed in decreasing order of magnitude by scalds (n = 209, 25%), chemicals (n = 19, 2%), and electricity (n = 11, 1%).

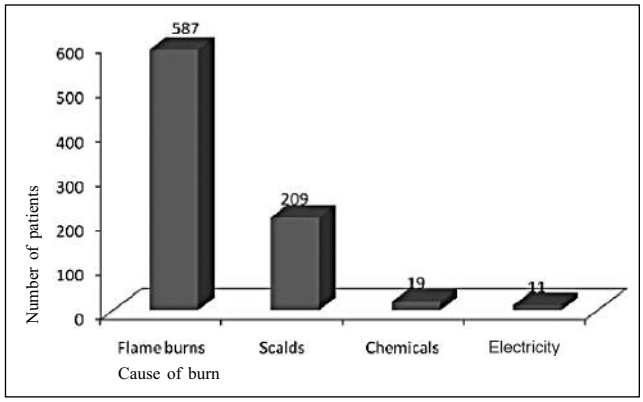

Fig. 3 - Aetiology of the burn injuries.

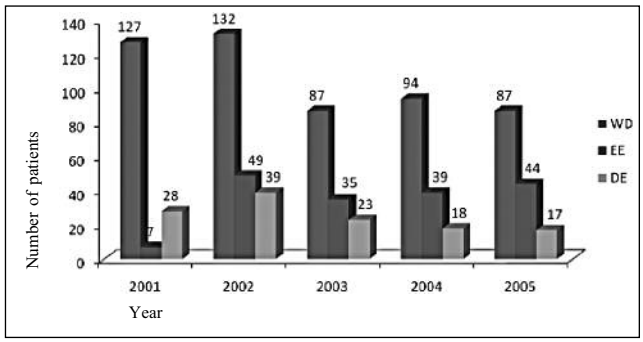

Fig. 4 - Types of burns treatment administered in the various years (WD = wound dressing; EE = early excision and split-thickness skin grafting; DE = delayed excision and split-thickness skin grafting).

Table I - Percentage of total body surface area (TBSA) burned and burns degree in the various years (2001-2005)

TBSA (%)	2001	2002	2003	2004	2005	Total		
						Number of patients	Second degree	Third degree
1-10	35	42	24	31	57	189	131	58
11-20	60	76	39	26	38	239	185	54
21-30	21	37	30	24	17	129	88	41
31-40	12	21	18	23	16	90	55	35
41-50	6	18	11	18	9	62	52	10
51-60	3	12	12	19	2	48	27	21
61-70	7	6	7	3	1	24	18	6
71-80	9	5	1	6	5	26	18	8
80+	9	3	3	1	3	19	12	7
Total	162	220	145	151	148	826	586	240

Burns treatment administered

Figs. 4 and *5* show the number of patients receiving the various types of treatment. Over time, surgical intervention became more widely used, while surgery itself was less frequently delayed. Early surgical intervention was thus the ideal mode of treatment.

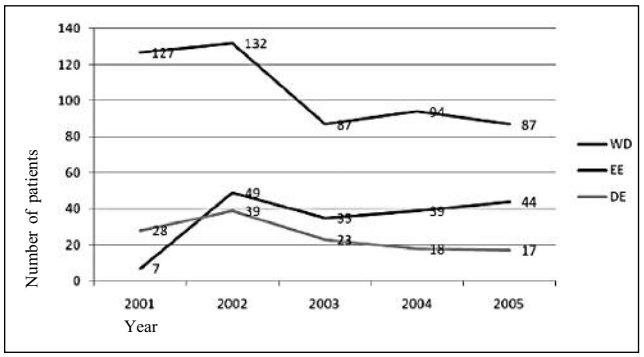

Fig. 5 - Burns treatment trends in the various years (WD = wound dressing; EE = early excision and split-thickness skin grafting; DE = delayed excision and split-thickness skin grafting).

Duration of hospital admission

The study also showed that the majority of the patients (n = 563, 68%) remained in hospital for less than 10 days after admission; 25% (n = 209) remained for 11-20 days (*Fig. 6*).

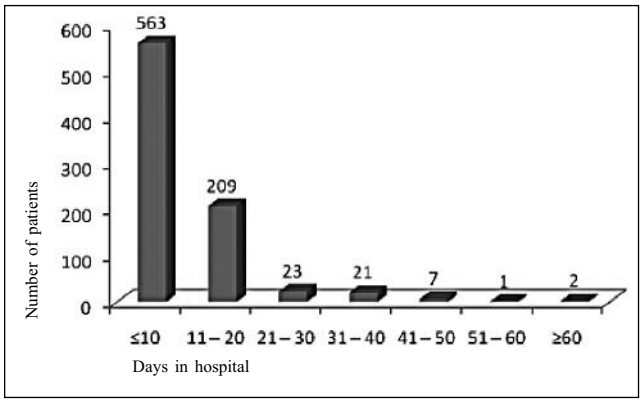

Fig. 6 - Duration of hospital admission.

Factors affecting mortality

The mortality trend showed a drastic decrease, from 2001 (20.4%) to 2002 (8.6%). This remained in single figures for the remainder of the study. Of the 86 deaths recorded in the study, 38% (n = 33) occurred in 2001 alone (*Table II*).

Table II - Total number of deaths recorded in the various years (2001-2005)

Year	Burn injuries	Deaths	Mortality rate (%)
2001	162	33	20.4
2002	220	19	8.6
2003	145	11	7.6
2004	151	12	7.9
2005	148	11	7.4
Total	826	86	10.4

Spearman's rank correlation graphs

The Spearman analysis was performed under a significance level of 0.05. The correlation is said to be significant when it ranges from +1 to -1. When an analysis is zero, it means there is no correlation between the parameters involved. Concerning the graphs, both axes had a scale factor of 10 to obtain the actual values.

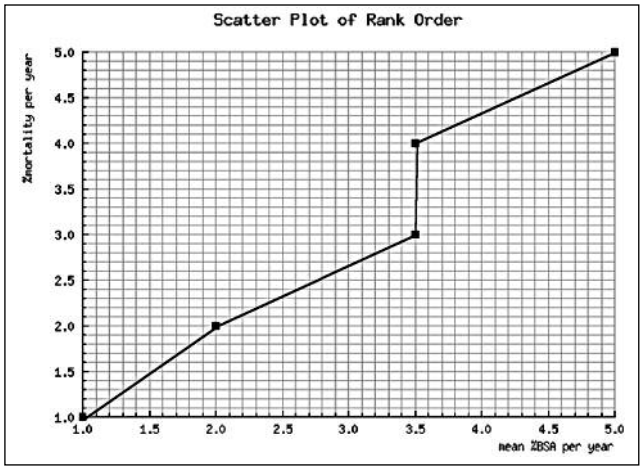

Fig. 7 - Graph of mortality rate measured against TBSA (%).

A high positive Spearman's rank order ($r_S = 0.98$) was recorded for mortality, and the mean TBSA analysis performed under a 0.05 significant level. *Fig. 7* shows a positive significant level, where the increase in the mean percentage TBSA correlates with the mortality rate.

Fig. 8 shows that a positive significant level was again recorded for the mortality rate and age distribution ($r_S = 0.5$). This indicates that as the age of the patients increased, the mortality rate also increased. Thus, the age of burn injury patients played an important role in their survival.

The correlation level between percentage TBSA burned and hospital stay showed a positive significant level ($r_S = 0.82$). Thus, an increase in percentage TBSA burned corresponded to an increase in the number of days the patient spent in hospital**.**

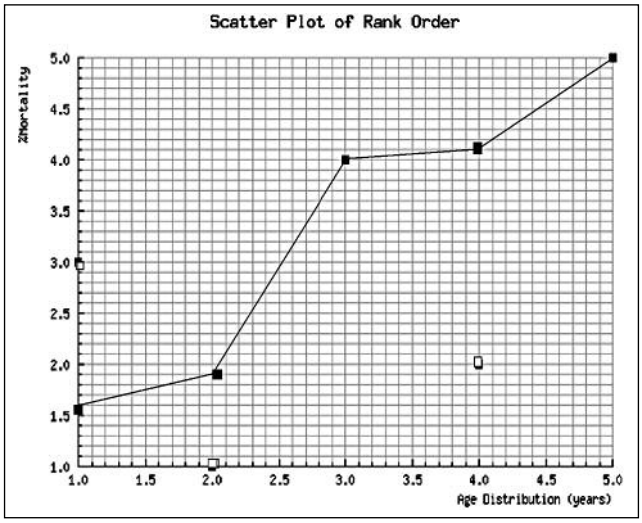

Fig. 8 - Graph of mortality rate measured against age (yr).

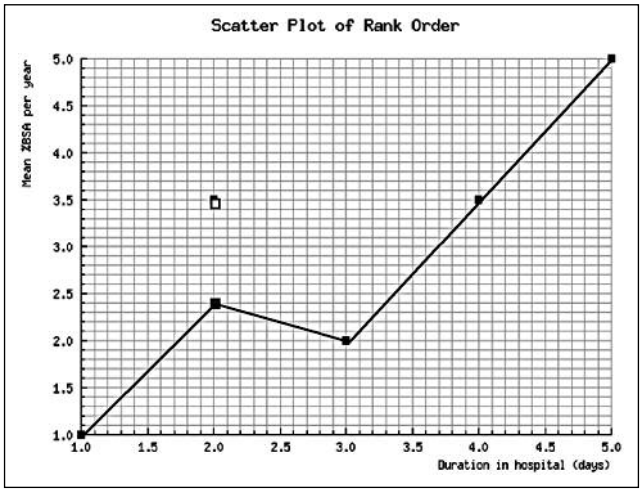

Fig. 9 - Graph of TBSA (%) against duration of hospital stay.

Discussion

Disability and mortality throughout the world are frequently caused by burn injuries. In the developed countries, the mortality rate is 2.1% per 100,000 person years.[21] However, in most low- and middle-income countries such as Ghana, the mortality is much higher. This study found that the burns mortality rate taken into consideration decreased after 2001, and the factors that may have contributed to the reduction were examined.

Age and sex are important epidemiological determinants for burn injuries. In this study more than half (n = 441, 53%) of the patients were ≤ 10 years of age, while 4% (n = 33) were over 50 years old (*Fig. 1*). The age distribution was similar to that found in other studies.[22-24] However, the discrepancy between the relatively low percentage of old people in our study and the higher percentage (16.7%) reported by Glasheen et al. in 1983 in the United States of America[25] may have been due to differences in social structure between Ghana and USA. In Ghana, older family members usually live within the family and are assisted by younger family members, thus decreasing their exposure to hazardous situations and hence their liability to injury. Also, behavioural patterns associated with age influence which groups are vulnerable to burns injuries. In children, the lack of knowledge of dangerous substances plays an important role in the occurrence of burns. In addition, inadequate supervision of young children and the lack of domestic safety measures may result in children being burned. The high incidence among young adults as compared to older people (over 50 years old), on the other hand, may be explained by the fact that they are generally active and exposed to hazardous situations both at home and at work.

As regards sex distribution in burn injuries, our study found that males (n = 492, 60%) outnumbered females (n = 334, 40%) in a ratio of 3 to 2 (*Fig. 2*). Studies in India,[26] Egypt,[27] Australia,[28] Britain,[29] and USA[30] showed similar trends. However, the studies of Singh et al.[31] in India reported a female predominance in burn injuries. The reason why male involvement in burns is greater than that of females, especially in the younger age group (≤ 10 years), is possibly that boys this age have an inquisitive and exploring nature. Another reason is that in Ghana adult males are generally at a significantly higher risk, since they are mainly employed in jobs involving the use of vehicles, factory work, and fuel-related occupations.

The findings of our study, in terms of the aetiological factors involved, indicate that burn injuries (*Fig. 3*), flame was the common factor, with a magnitude of 71% (n = 587). Flame burns included: gas explosions, petroleum, and burning wood/bush/clothing. In decreasing order of magnitude the other recorded factors were scalds (n = 209, 25%), chemicals (n = 19, 2%) and electricity (n = 11, 1%). Similar results have been reported from Egypt,[24,32] India,[33] Jordan,[34] and Nigeria.[35] Aetiological factors are highly specific to each country, largely depending on the standard of living and lifestyle. Although scalds affected only 25% of our patients, they were found to be the most frequent aetiological factor of burn injuries in reports from Japan[36] and Nigeria,[37] representing some 40%-78% of cases. The difference in ranking of different agents could be attributed to the developmental stage of the country, the age composition of the sample, and whether out-patients were included or not.[24]

The Spearman analysis may be due to a strong positive correlation between mortality, age, and TBSA (*Figs. 7, 8*). Another significant correlation was identified between TBSA and hospital stay (*Fig. 9*). This is consistent

with the study of De Souza et al. from Brazil, which shows increased mortality with increased age and burn surface areas.[38] Olaitan and Jiburum reported a similar correlation in their study in Nigeria.[35] Our study recorded that mortality decreased drastically from 2001 (20.4%) to 2002 (8.6%) and was still in single figures until 2005. In all, 86 deaths were recorded in the study, of which 33 (38%) occurred in 2001 alone (*Table II*). Though other studies[35,38] have reported decreases in burns mortality, these have not been as marked as that in our study. Our findings suggested that the drastic change in mortality might be due to advances in surgical technique, to the increased number of plastic surgery medical personnel, and to efficient treatment protocols. *Figs. 4* and *5* illustrate the statistics of treatment during the study, indicating where early excision and STSG had increased. This early surgery intervention also contributed to reducing the number of days spent by patients in hospital. *Fig.* 6 shows that majority (n = 563, 68%) of the patients spent less than 10 days in hospital after admission. The findings of our study confirm those of Atiyeh et al.,[14] who reported that early excision of burned skin reduced the risk of septicaemia, mortality, morbidity, hospital stay, and cost of treatment.[3] In addition, Ramakrishnan and Jayaraman[19] reported that the lack of well-trained, motivated burns surgeons could worsen the burns mortality situation in the developing countries as well. The reverse proved true in our study, since the number of burns surgeons, nurses and other personnel increased in the successive years of the study; this reduced both mortality and the duration of hospitalization admission among the burns survivors.

Conclusion

Over the period in question, the mortality rate fell as the relative number of burn injury cases increased. Proper case management - involving efficient treatment with emphasis on early surgical intervention, and an increase in the number of professional medical personnel and in their dedication to their work - were factors that affected the mortality trends and the duration of admission.

RÉSUMÉ. Les Auteurs de cette étude, dans le but d'examiner les facteurs qui influaient sur les résultats du traitement des patients hospitalisés dans l'unité de soins intensifs auprès du Centre des brûlés (SICB) de l'hôpital universitaire Komfo Anokye, Kumasi, Ghana, ont enregistré les informations sur les patients admis au Centre entre février 2001 et janvier 2006. Les paramètres enregistrés incluaient: dossier d'admission et démographie, causes de l'accident, extension de la surface brûlée, les analyses de laboratoire, le régime de traitement, et le résultat final (sortie de l'hopital ou décès). Les données ont été analysées avec SPSS version 12,0 et corrélation de rang de Spearman. En tout, 826 patients ont été enregistrés; les mâles (n = 492, 60%) étaient plus nombreux que les femelles (n = 334, 40%). L'âge moyen était de 10,5 ± 5 ans, la majorité (n = 441, 53%) dans l'intervalle 0-10 ans. Les trois causes les plus importantes des brûlures étaient les flammes (n = 587, 71%), les ébouillantements (n = 209, 25%) et les produits chimiques (n = 19, 2%). L'extension moyenne de la surface corporelle totale brûlée (SCTB) variait entre 11 et 20%; dans 94% des cas (n = 775) la SCTB n'excédait pas 60%; 527 patients (64%) ont été traités seulement avec des pansements; et 174 patients (21%) ont subi l'excision précoce suivie de greffe cutanée et 125 (15%) l'excision retardée suivie de greffe cutanée. La plupart des patients (n = 563, 68%) ont été hospitalisés moins de 10 jours. Le taux de mortalité a diminué au fil des ans, en manière marquée entre 2001 (20,4%) et 2002 (8,6%) pour rester au niveau d'un seul chiffre en 2003 (7,6%), 2004 (7,9%) et 2005 (7,4%). Une prise en charge plus adéquate et l'incrément du personnel médical et de son dévouement ont constitué les facteurs majeurs qui influaient sur les tendances de la mortalité.

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