

ORIGINAL ARTICLES**BURN INJURIES IN KUMASI: A TEN-YEAR REVIEW****Adu E J K, Koranteng A**

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Abstract

Objective: To document the clinical and epidemiological features; and the outcome of management of patients with burn injuries at Komfo Anokye Teaching Hospital in Kumasi, Ghana, from January 2003 to December 2012.

Patients and Methods: Data on all burn patients managed within the study period were retrieved from the records of the Burns Intensive Care Unit (BICU), theatre and Surgical Outpatient Department (SOPD) and analyzed. Data included name, age, sex, cause of burn, medical and surgical treatment given, post burn complications and the outcome of the treatment.

Results: 1361 patients were treated for burn injuries and their complications at KATH, comprising 707 males and 654 females (M: F = 1.08:1). Ages ranged from 0.25 to 92 years; mean 15.5 (SD 14.1) years, median 11.9 years. About 77% of the patients were aged 20 years or less; 45% were children aged 10 years or younger. The highest annual admission was 172

patients in 2005; the lowest 104 in 2007. Scalds comprised 60% of the injuries, hot water accounting for 45%. Dry heat was responsible for 37% of the burn injuries. Chemical burns accounted for 28 (2%) injuries which led to loss of vision in two cases and one death; all of which were through assault. Electrical burns accounted for 12 (0.9%) of the injuries and led to six limb amputations and three deaths, all of them workers of electricity companies. A total of 162 patients died of burn injuries, giving an overall mortality of 11.9%. The highest annual mortality of 32 (29%) occurred in 2008, which coincided with 4 major burn disasters. Peri-operative deaths occurred in four epileptic patients.

Conclusion: Though injuries from hot liquids account for most admissions for burns at KATH, significant morbidity and mortality also result from dry heat. Electrical and chemical burns and epilepsy are increasingly becoming responsible for most burn morbidity.

Key Words: *Burn injuries, scalds, electrical, chemical, contractures*

INTRODUCTION

A burn injury to the skin usually results in local destruction of tissue and also elicits a systemic inflammatory response¹. The injury can damage the epidermis alone, the epidermis and a portion of the dermis, or the entire skin, and can even involve the underlying subcutaneous tissue². Severe burn injury impairs the host defence mechanisms against invading micro-organisms.

This increases susceptibility to infections by human pathogens, and also by organisms not normally pathogenic in the uncompromised host³. Burn survivors are often left with stigmata such as hypertrophic scars, keloids and contractures. In addition to cosmetic problems, these scars may cause dysfunction and discomfort leading to significant morbidity⁴. Cosmetic problems may affect burn survivors psychologically, socially and economically⁵.

The causes of burn injuries in a community may be related to social, recreational, occupational and economic factors. Burn injuries are usually sustained accidentally, though on some occasions, they may be sustained intentionally through assault⁶. The objective of the study was to document the clinical and epidemiological features; and the outcome of management of patients with burn injuries at Komfo Anokye Teaching Hospital in Kumasi from 2003 to 2012. This knowledge would aid in improving overall management of burn injuries and identify opportunities for prevention of burn injuries.

PATIENTS AND METHODS

This is a retrospective study of patients with burn injuries who were managed at the Reconstructive Plastic Surgery and Burns Unit (RPSBU) at Komfo Anokye Teaching Hospital (KATH) in Kumasi, Ghana, between the period from January 2003 to December 2012. Data on all the burn patients managed within the study period were retrieved from the records of the Burns Intensive Care Unit (BICU), theatre, and the surgical out-patient department (SOPD) of KATH. Data collected included the name, age, sex of the patient, the cause of the burn injury, the medical and

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surgical treatment given, and the outcome of the treatment. Data was also collected on post-burn complications, how they were managed, and the outcome of management.

The patients with acute burn injuries were admitted to the RPSBU at KATH. Initial assessment included ensuring a patent airway with adequate respiration and circulation. Intravenous access was then established. After exclusion of any other life threatening injuries, the extent of the total body surface area (TBSA) involved was estimated using the Lund and Browder chart⁷. The patient was then weighed. Fluid requirements were calculated using the Parkland formula⁸ (4ml/kg/% TBSA). Patients selected for fluid resuscitation included children with more than 10% TBSA [Fig. 1], or adults with more than 15% TBSA and patients with electrical or chemical burns. The fluid of choice for initial burn resuscitation was Ringer’s lactate.



Fig.1: Full thickness burns in a 4 month old baby requiring urgent resuscitation and wound excision

The burn wounds were toileted with a warm antiseptic (e.g. savlon) solution and rinsed with normal saline. Silver sulphadiazine (dermazine), a topical antibiotic was applied to the wounds. Closed (occlusive) dressing was done for wounds involving the trunk and limbs. Open dressing of the wounds were done for injuries involving the face, genitalia or perineum and the hands.

Surgery for burn injuries was either performed as an emergency (within 24 hours of injury) or early (acute stage up to complete healing) or late (after complete healing of wounds). The following categories of injuries were selected for surgery: full thickness burns, especially circumferential ones of the trunk or extremities, deep dermal burns of special areas such as the hands, face and genitalia, infected burns, burn wounds not healed after three weeks of conservative treatment, and deep dermal chemical and electrical burns. Emergency surgery for burns included escharotomy, early excision and grafting of deep dermal wounds, and wound debridement of deep electrical burns. Early surgery involved excision and

grafting of burn wounds, wound debridement, skin grafting and flap reconstruction. Late or secondary surgery involved the release of contractures and repair with z-plasty, local or distant flaps, or skin grafts to improve or restore function. Late surgery also included revision of scars to improve cosmesis.

RESULTS

A total of 1361 patients were treated for burn injuries at the RPSBU of KATH in Kumasi from January 2003 to December 2012. They comprised 707 males and 654 females, giving a male to female ratio of 1.08: 1. The yearly admissions and deaths from burn injuries are shown in Fig. 2. Out of the 1361 admitted for treatment 162 died from causes related to the burn injuries, giving a mortality of 11.9%. The year 2005 recorded the highest admission of 172 patients, but with 14 (8%) deaths. The highest mortality of 32 (29%) occurred in 2008 with a lower admission of 110 patients.

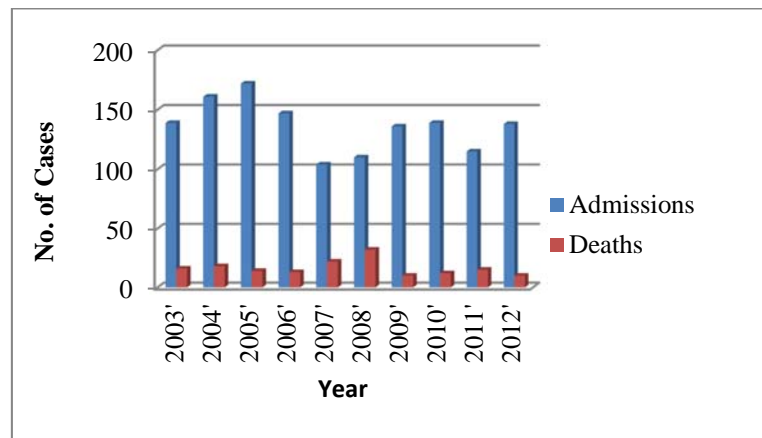


Fig. 2: Admissions and deaths of 1361 patients treated for burn injuries at KATH.

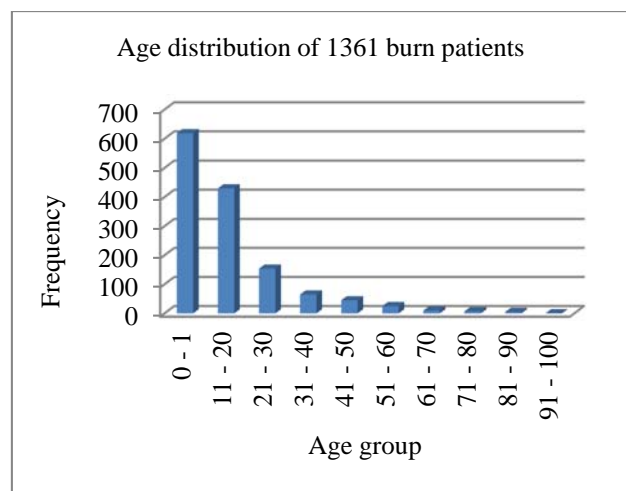


Fig. 3: Age distribution of 1361 patients treated for burn injuries at KATH

The age distribution of the 1361 patients treated for burn injuries at KATH is shown in Fig. 3. Their ages ranged from 0.25 to 92 years with mean age of 15.5 years, median of 11.9 years and standard deviation of 14.1. About 77% of the patients were aged 20 years or less, with about 45% comprising children aged 10 years or younger.

Burn injuries caused by hot liquids (scalds) comprised 60%; hot water alone was responsible for 44% of the admissions [Fig. 4]. Most of the children who were 10 years or younger sustained their burn injuries from hot water [Fig. 5]. Dry heat comprising fire and flames, including domestic (liquid petroleum) gas explosions comprised 502 (37%). Injuries from hot water, domestic gas, soup and cooking oil (1045, 76.8%) occurred in the homes, especially in the kitchen.

Conservative management of burn injuries including fluid and electrolyte resuscitation, analgesics, antibiotics and wound dressing was adequate treatment for 719 (52.8%) of the patients. These patients had partial thickness wounds which healed by the third week. 642 (47.2%) of the patients had to undergo a surgical procedure, some more than once [Tables 1 & 2], for the following reasons: to replace the damaged epithelial layer, to reduce fluid and electrolyte loss, to reduce bacterial load in infected cases, to save limbs at risk of ischaemia and gangrene, and to restore or improve function and cosmesis in those who had survived the acute injury.

Skin grafting was the commonest (48%) surgical procedure performed for burns in this series; it was performed as an emergency, as an early procedure,

Table 1: Surgical procedures performed on 642 patients with acute burn injuries

Emergency	
Escharotomy	10
Excision and grafting	10
Debridement	19
Early	
Split Thickness Skin Grafting	290
Debridement	16
Excision and grafting	13
Amputations: below elbow	10
Above knee	6
Below knee	3
Flap repair	6
Late	
Release of contracture	248
Flap repair	68
Full thickness skin graft	50
Total number of procedures	749

and for late burn reconstruction. In the latter situation only full thickness skin grafting (7%) was done. Wound debridement was performed as an emergency procedure in 19 (2.5%) patients who had sustained deep dermal burns from electricity, and as early procedure in 16 (2.1%) patients with thermal burns. Amputation had to be performed in 19 (2.5%) patients whose injuries were sustained through full thickness electrical burns (10) and epileptic patients who had sustained burns during a seizure (9). Escharotomy was performed as an emergency procedure in 10 patients with circumferential burns to the lower extremity to decompress neurovascular structures (8 cases), and the trunk to prevent respiratory impairment (2 cases). Release of contracture, which is usually performed as a late or secondary procedure for burns, was a common surgical procedure (248, 33%) in this series, second only to skin grafting. Repair of some defects following contracture release were done with flaps (68, 9%); some flaps were also employed in early burn surgery (6,0.8%). Details of the flaps used in the reconstruction of the burn wounds in this study are shown in table 2

Table 2: Flaps used in burn reconstruction

Type of flap	Number used
Z-Plasty	28
Cross finger	20
Parascapular	12
Groin (SCIA)	10
Cervical (X-plasty)	2
Local	2
Total number of flaps used	74

DISCUSSION

The higher incidence of burn injuries in the age group 0 – 10 years, followed closely by 11 – 20 years (Fig. 3) coincides with the higher incidence in the months of August, September and October.

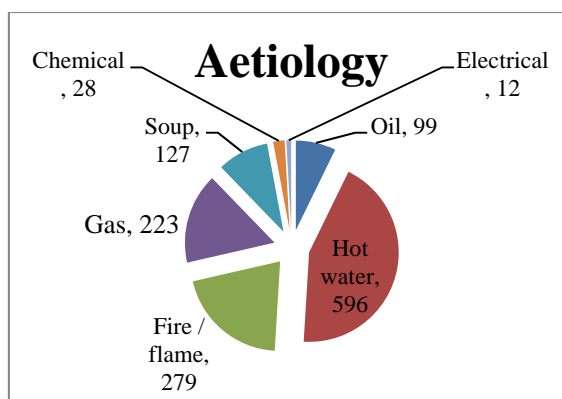


Fig. 4: Aetiology of 1361 cases of burn injuries managed at KATH

The commonest cause of burns in these age groups was hot liquids, especially hot water (Fig. 5). The

weather in these months is much cooler, requiring hot water baths in most homes. Water for bathing is usually heated to boiling point before diluting with cold water to the desired temperature for bathing children. In the meantime toddlers playing around may either fall into it or spill it over themselves sustaining scalds. Similarly burn injuries are sustained from hot soups and frying oils in the big compound houses with no running water and poor electricity supply, where several tenants cook in front of their rooms. The children playing nearby in the court yard become victims of burn injuries. Even though the total body surface area involved in such injuries may be large, most wounds tend to be superficial and heal by conservative management without surgical intervention.

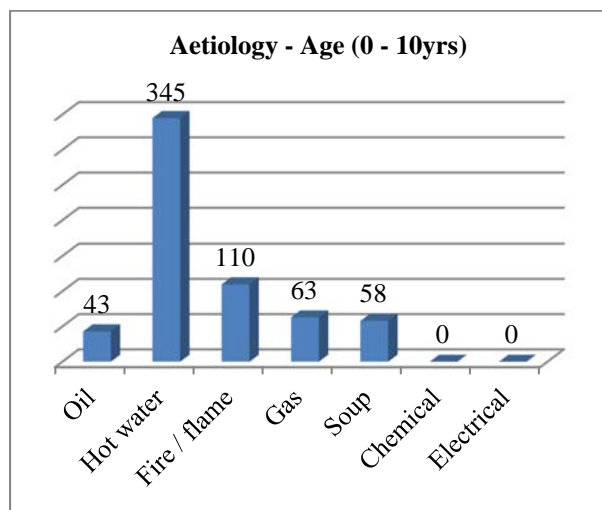


Fig. 5: Causes of burn injuries in children aged 0 – 10 years seen at KATH from 2003 to 2012

The higher incidence of burns in children under 10 years of age has also been documented in similar studies. A study in the Western Cape province in South Africa [Nierkerk et al, 2004]⁹ revealed that burn injury incidence was particularly high for toddlers and infants, for boys and for African children. Burn injury incidence was highest in winter but only significantly greater than the rate in summer⁹. A similar study in Bangladesh also revealed that the highest proportion of non-fatal burn injuries (57%) was found among children one to four years old¹⁰. It appears that parental guidance for these vulnerable children trying to explore their environment is not meticulous.

Scalds are the most frequent form of burn injuries worldwide and cause over 100,000 patients to seek treatment in hospital emergency units, but fire or flame burn is the most frequent cause of burn injury requiring hospital admission¹¹. The number of children admitted to hospital for burn treatment has varied by geographic area from a low rate of 4.4/100,000 population in America to a high of 10.8/100,000 population in Africa¹².

Domestic gas (223, 16%) was responsible for several house wives and house helps becoming victims of burn injuries. Leaking gas cylinders, faulty cylinder caps and tubes resulted in frequent gas explosions in homes. These findings support the observations in South Africa⁹ and Bangladesh¹⁰ which found the home, especially the kitchen, as the most dangerous place in terms of burn injuries.

Chemical burns constituted 2% (28) of the cases of burn injuries seen during the study period. Unlike the other cases these injuries were not accidental. The chemical had been used as a weapon of assault on the patients. The chemical involved was usually concentrated sulphuric acid used as the electrolyte in some automobile batteries. This is purchased, prepared or stored by auto-electricians and used to service vehicles. Similar chemicals are stored by small scale miners and are used to extract minerals from ores. The reason for the assault was usually related to love or marital relationship failures, chieftaincy or land disputes, religious or political conflicts. The victims were usually young men and women within the ages of 20 and 40 years. The assailants usually aimed at the victim's face, especially the eyes.

Most patients were not aware of, and did not do the copious irrigation of the site with water before arrival at the hospital. The injuries were extensive, and required multiple surgical procedures before satisfactory healing could be achieved. One patient died, and two patients lost vision in one of their eyes from chemical burn assaults. A study on chemical burn injury in Nigeria¹³ revealed that the injury was intentional in all cases with the assailant known to the victim in 73% of the cases. The face was the usual target with an incidence of blindness of 55%. The study recommended public education on the usefulness of continuous water irrigation as the first aid measure¹³.

Electrical burns constituted 0.9% (12) of the burn injuries seen in this study. The victims comprised 2 electrical engineers, 4 technicians and 2 student electricians. Four children also sustained their electrical burn injuries by playing near electrical installations. The tissue damage caused to these patients were extensive and required several surgical procedures including wound debridement (10), amputations (6) and flap repair (4). The initial wound debridement was essential as any remaining non-viable tissue could lead to infection and tissue loss¹⁴. Despite aggressive debridement and escharotomy the likelihood of amputation is usually very high in electrical burn injuries especially in the upper extremity¹⁵. Full recovery from electrical burn injuries in this series was rather prolonged, with a minimum period of three months. It was also associated with co-morbid conditions such as malnutrition (2 cases), anaemia (2 cases) and renal failure (one case). Three patients died from electrical burn injuries in this study.

About 88.1% of the patients survived the acute burn injuries due to prompt and effective fluid and

electrolyte resuscitation, wound care, infection and pain control. However most of these patients presented with complications, some of which required surgical correction. Contractures were the commonest complications, involving especially the head and neck and upper extremity, especially the hand. Most of these contractures were repaired through multiple Z plasty (28, 38%) technique. The contractures on the fingers tended to involve the volar aspects, causing flexion of the digits. The cross finger flap (20, 27%) was found to be useful for repairing defects following release of these flexion contractures¹⁶. Post burn axillary contractures were very common in adults, and resulted from flame burns, especially involving clothing. The parascapular flap (12, 16%) was employed to repair major defects in the axilla following release of these contractures [Fig.6]¹⁷. For most extensive defects on the hand and forearm from electrical burn injuries pedicled groin flaps (10, 13.5%) provided good coverage¹⁸.



Fig.6: Post burns axillary and elbow contractures, before and after surgical release and flap repair.

The highest mortality per year from burns in this study occurred in 2008 with 32 deaths. That year recorded four major fire disasters in the middle belt of Ghana, which form part of the catchment area for Komfo Anokye Teaching Hospital in Kumasi. The Asokwa gas filling station explosion injured 136 patients and claimed three lives: the Asafo petrol tanker accident injured seven people out of which one died; the Atwedie gas tanker accident injured seven patients out of which three died; a major petrol tanker accident at Techiman injured 19 people, out of which 13 died. These observations support the finding by other workers^{11, 12} that dry heat (flame burns) is responsible for most burn mortality.

One medical condition which predisposes to burn injuries in Ghana is epilepsy¹⁹. Epileptics tend to sustain severe burn injuries because they are sustained during a seizure, when they are unconscious and hence cannot escape until the seizure is over, or are rescued by a passer-by. In some communities in Ghana some people believe that epilepsy is contagious; such people are reluctant to rescue epileptics lest they come into contact with their body fluids such as saliva, which they believe, transmits the disease. Most burn injuries in epileptics require surgical management. In the current study, seven epileptic patients underwent

wound debridement and skin grafting for full thickness burns. Three of them had persistent seizures intra-operatively, and died from hypoxic brain damage. The fourth died in the second postoperative week from multiple organ failure. Nine other epileptic patients underwent amputations for severely burnt and gangrenous limbs. Public education by health personnel on the nature of the disease and the need to protect the patients from fires is highly recommended.

CONCLUSION

Though injuries from hot liquids are responsible for most admissions for burns at Komfo Anokye Teaching Hospital, significant morbidity and mortality result from dry heat. Electrical burns as occupational hazard, chemical burn as weapon of assault and epilepsy as a predisposing medical condition are increasingly becoming responsible for major burn morbidity. Chemical burn injury is gradually becoming a public health hazard in Ghana. We recommend that the sale of these chemicals should be regulated by law.

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