CURRENT LOGISTICS OF ACUTE BURN CARE IN SINGAPORE

R C K Ngim, A K Ghulam

ABSTRACT

Objective: To study logistic requirements in acute burn care in Singapore and to correlate statistics on fire, unnatural deaths and burns.

Design: Fire data (from Singapore Fire Safety Bureau), mortality data (from Institute of Science & Forensic Medicine) and burn data (from Burns Centre, Singapore General Hospital) were studied.

Setting: Severe burn victims often require prolonged treatment. Useful data was obtained in a 1,500-bed restructured government hospital.

Participants: All reported and investigated fire incidents, coroner enquiries of unnatural deaths and admitted burn patients.

Intervention: General burn data obtained retrospectively from 398 burn admissions in 1988 and logistic burn data from 41 patients requiring fluid replacement regime.

Results: Fire data showed one burn admission in every 12 fires (398/4718), one burn death in every 314 fires (15/4174) or 55 unnatural deaths (15/828).

Mortality data showed 15 burn deaths, two prior to admission, 7/13 admitted died of suicidal injuries and mortality rate was 3.3% (national annual average is 1.9%).

General burn data showed adults 76% and children 24%, 3:1 male predominance; scalds (46%), fire (32%), explosions (11%) and others (11%). Seventy-eight patients (adults 58, children 20) required fluid resuscitation.

Logistic burn data (average burn 35%, 28 partial thickness and 13 full thickness burns) were: ALOS 19.5 days, 2.4 major operations per patient (range 2-7), 56 minor procedures and 2.9 L blood transfusion per patient (those who were operated required 3.8 L and those not operated, 1 L per patient).

Blood investigations increased with severity and pattern of injury, Acinetobacter species was commonest microorganism, antibiotics were used in 66% of patients and commonest burn dressings were tullegra (T/G), followed by T/G with silverzine.

Conclusion: Data presented useful for correlation of fire, mortality and burn statistics, resource allocation and new burn facility establishment.

Keywords: burns management logistics, burns resource allocation, resource management, burns administration

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INTRODUCTION

Specialised burn treatment centres are important basic infrastructure in any industrialised or industrialising country. Singapore is fortunate in having a burns centre in the past decade. Although essential, cost of maintaining such infrastructure periodically comes up for review, particularly in a cost conscious environment.

However, data on logistics involved in burn care are not readily available. The primary aim of this paper therefore is to review a year of acute burn care at the Singapore General Hospital, a 1500-bed acute care teaching hospital to gather data on admission, survival rates, length of stay and logistics involved in the management of acute burn injuries. The data available from this study will assist in optimising utilisation of the facilities of the burn centres, allow for planning, budgeting and auditing current practices and procedures. The study excludes considerations from a standpoint of manpower, capital expenditure and support services required in running the burns centre. The turning point for this study was aptly chosen in the year 1988, a landmark year prior to the restructuring of the Singapore General Hospital.

Included in this study are some basic data on fire statistics and mortality data from autopsies. Such information will provide a complete picture as to the impact of fire on human lives and property.

Department of Plastic Surgery
Singapore General Hospital
Outram Road
Singapore 0316

R C K Ngim, MBBS, FRCS (Edin), FAMS
Consultant Plastic Surgeon

Burns Centre
Singapore General Hospital

A K Ghulam, MBBS (Chittagong)
Visiting Colombo Plan Fellow

Correspondence to: Dr R C K Ngim

MATERIALS & METHODS

There were three sources of data. They were:

a) Fire data from the Singapore Fire Safety Bureau,
b) Mortality data from the Institute of Science & Forensic Medicine, and
c) Burn data from the fifty-four bedded National Burns Centre at the Singapore General Hospital.

All data were collected in 1988. a year which the Chinese almanac attributed to the year of the fiery dragon. and is commonly believed to have more burn injuries.

All burn data were collected from patients who were admitted to the burns centre during the year from 1 January to 31 December 1988. Criteria for admission of burn cases have been previously published and were adhered to[1]. A protocol was used to review the diagnosis of burns in relation to extent, depth, location and aetiology. Data on logistics such as length of stay, major and minor procedures, blood transfusions, blood investigations, microorganism profilc, antibiotic usage and burn dressings were retrospectively collected and entered into the protocol by the second author. A total of 41 adult patients who required burns regime was entered into this protocol for indepth logistic study. Our standard fluid replacement is based on the Mt. Vernon colloid burns regime which is indicated in adults with burns involving 15% or more of total body surface area (TBSA) and in children with burns involving 10% or more of TBSA.

Data from the three sources were analysed separately and cross correlations were made. The burn data were categorised into a general data analysis of the 1988 cohort of burn patients and a specific analysis for logistic data on 41 patients. In view of expected skewed distribution and anticipated outcome, this latter logistic analysis group were sub-divided into 4 groups based on the extent of burns:

Group A	15 – 29%
Group B	30 – 44%
Group C	45 – 59%
Group D	60 – 100%

RESULTS

1) Fire data

In 1988 there were 4,718 confirmed and investigated fire incidents in Singapore out of a total of 10,902 calls to the Singapore Fire Service.

Forty-eight percent of these fires occurred in residential structures and the predominant cause of fires in Singapore was 'light thrown down' (lighted cigarettes, matches, etc) (51%) (Table I). This cause is preventable and avoidable.

Deaths resulting from fire incidents in Singapore gave a figure of 15 deaths to 4,718 fires or one death in every 314.5 fires.

Burn admissions resulting from fire incidents in Singapore gave a figure of 398 admissions for 4,718 fires or one burn admission for 11.9 fires.

Table I – Classification and causes of fire in Singapore in 1988

Fire classification	**No. of fires**	**(%)**
Structural residential	2,269	(48.0)
Structural non-residential	683	(14.5)
Non-structural	1,766	(37.5)
	4,718	100%
Fire causes	**No. of fire**	**(%)**
Light thrown down	2,426	(51.4)
Electrical	600	(12.7)
Overheating of food	533	(11.3)
Sunrays	345	(7.3)
Naked light	225	(4.8)
Overheating machinery	177	(3.8)
Sparks	118	(2.5)
Others (chemical)	294	(6.2)
	4,718	100%

2) Mortality data

In 1988 there were 828 deaths from unnatural causes which were reported and investigated by the forensic pathologist when the cases came up for review by the state coroner. Burns accounted for 15 deaths. Therefore burn deaths accounted for 15 in 828 unnatural deaths or one burn death in 55 unnatural deaths. There were 12 adults and 3 children burn deaths. Two patients died before reaching a hospital. There were 7 burn deaths from suicides which included a family of two adults and 3 children who were involved in a suicide pact by the parents.

Thirteen patients died in the Burns Centre, giving a mortality rate of 3.3%. The aetiology of deaths were fire in 8 and explosion in 5. Except one patient all sustained respiratory burns and full thickness injury. Three died having Group B extent of injuries (30-44%), one in Group C (45-50%), and 9 in Group D (60-100%).

Causes of death as confirmed by post mortem findings were extensive severe burns, septicaemia, bronchopneumonia, coagulopathy and severe metabolic acidosis. Frequently, more than one cause were found. Table II summarises the classification of burn deaths. It was interesting that there were no deaths caused by burns in all unnatural deaths arising from road traffic accidents (RTA).

Table II – Classification of burn deaths in 1988

Classification	Unnatural deaths	Burn deaths
Suicide	420	7
RTA	245	0
Industrial	81	2
Homicide	51	3
Domestic	31	3
Total	828	15

RTA: road traffic accidents

3) Burn data

(I) General data of 1988 cohort (398) patients

Admission : In 1988 there were 398 burn patients admitted into the burn centre.

Age : There were 305 adults (76.6%) and 93 children (23.4%).

Sex : There was a sex ratio of 3:1 male predominance.

Extent : There were 58 adults with burns of 15% and above and 20 children with burns of 10% and above. Therefore a total of 78 patients showed that the majority (229 adults and 73 children) did not require resuscitation regime although they were closely monitored. There were 18 adults with pure inhalational injuries.

Table III – Extent of burns

Adults		**Children (12 years & <)**	
< 15%	229	< 10%	73
15 – 30%	33	10 – 30%	16
> 30%	25	> 30%	4
Inhalational	18		
	305		93

Survival rate : This group of patients showed a survival rate of 96.7% as there were 13 mortalities. (Mortality rate was 3.3%).

Aetiology : The commonest causes were 46% (185) scalds, 32% (85) fire and 11% (43) explosions. There were 28 chemical, 22 contact, 17 electrical and 18 miscellaneous burn cases.

(II) Logistic data (41 patients)

(a) Extent & Depth of Injury

Forty-one adult patients with 15% burns and above were studied in detail. The extent and depth of injury are shown in Table IV. Based on extent of burn, patients were classified into four groups: A (15-29%), B (30-44%), C (45-59%) and D (60-100%).

Average extent of burn was 35%. Twenty-eight had partial thickness injury and thirteen had full thickness injury.

Tabl IV – Extent and depth of injury

	Depth				
Group/Extent	Superficial Dermal	Middermal	Deep Dermal	Full Thickness	Total
A 15- 29%	3	14	4	3	24
B 30- 44%	–	1	2	4	7
C 45- 59%	–	–	1	2	3
D 60-100%	–	–	3	4	7
Total	3	15	10	13	41

(b) Length of Stay (LOS)

The 41 patients stayed a total of 801 days thereby giving an average LOS of 19.5 days. Table V shows the average LOS in relation to extent of injury.

Table V – Average length of stay (A.LOS)

Group	Patients	Days	A.LOS
A	24	429	17.9
B	7	130	18.6
C	3	159	53.0
D	7	83	11.9
Total	41	801	19.5

(c) Major Operations

Major operations were carried out in 14 of the 41 patients. This worked out to 2.4 operations per patient or a range of 2-7 operations were done in patients who had deep dermal or full thickness injuries where skin replacement was required. In the absence of a skin bank we practise staged excision whilst waiting for the donor site to recover for a second cropping.

Thirty-four operations in the form of tangential excision with skin grafting or desloughing with skin grafting were performed. In one child bilateral above knee amputations were performed. Nine patients had one to two operations and five had three to seven operations. All the patients with more operations had deep dermal or full thickness injuries.

Table VI – Major operations

Group	No. of operations	No. of patients who required operations	Range of no. of operations	Total no. of operations
A	24	5	1-4	10
B	7	4	1-4	7
C	3	3	2-4	12
D	7	2	1-4	5
Total	41	14		34

(d) Minor Procedures

A total of 56 minor procedures were performed as shown in Table VII. Bronchoscopy was routinely performed for diagnosis of respiratory burns and decision for intubation was based on clinical and bronchoscopic findings. All the seven Group D patients required two or more of the listed minor surgical procedures. Intravenous access lines were excluded in this study.

Minor procedures required based on extent of injury gave an inverse relation mathematically represented by Group A 0.33, Group B 2.15, Group C 2.0 and Group D 3.8. It indicates that the more extensively burned patient will require more minor procedures and efforts to salvage.

Table VII – Minor procedures

Group / Procedure	A (15-29%) (n = 24)	B (30-44%) (n = 7)	C (45-59%) (n = 3)	D (≥ 60%) (n = 7)	Total (n = 41)
Escharotomy	1	–	–	2	3
Cutdown	–	–	–	2	2
Bronchoscopy	4	4	2	4	14
CVP Line	1	4	2	3	10
IA Line	–	1	–	2	3
Intubation	1	3	1	7	12
Respirator	1	3	1	7	12
Total	8	15	6	27	56

IA: intra arterial

(e) Blood Transfusion

Blood replacement in a severely burned patient serves to restore the haemoglobin that has been destroyed by the thermal injury, provide an oxygen transport mechanism for early wound healing and to restore operative losses. The blood requirement in the operated group is expected to be more. However, earlier replacement of skin coverage and restoration of the normal protective barrier to infective organisms results in earlier recovery of the patient from his injury. In this study the utilisation of plasma was not conducted as the volume used could be estimated using the colloid based on the Mt. Vernon regime which has been used with success since 1972.

Twenty of the forty-one patients (48.8%) did not require blood transfusion. Two of these with more than 60% burns died. The remaining eighteen with burns up to 44% and partial thickness injury did not receive blood transfusion.

Twenty-one patients (51.2%) required blood transfusion. Of these, 14 patients were operated on but 7 did not need operation. The 14 patients who were operated on required 52,900 ml of blood and the remaining seven required 7,170 ml of blood. Therefore these 21 patients received 60,070 ml of blood or 2.86 L per patient. Those who were operated on required an average of 3.78 L and those who were not operated on required 1.02 L. In the latter category of patients who were not operated upon, 4 had burns up to 29% (Group A) and 3 had more than 60% burns (Group D). Although patients who were operated upon required more blood, they recovered earlier as there was earlier coverage of the burn wound. Table VIII shows the blood requirements in relation to extent of burn and operation.

Table VIII – Blood tranfusion requirements

Group	Patients operated	Blood tranfused (ml)	Patient not-operated	Blood transfused (ml)	Patients not operated and not transfused
A	5	11,090	4	1,770	15
B	4	9,550	0	–	3
C	3	22,980	0	–	0
D	2	9,280	3	5,400	2 (died)
Total	14	52,900	7	7,170	20

(f) Blood Investigations

All patients required haematologic, coagulation profile studies,electrolytes and blood gases. With increased severity of injury the frequency and necessity of the investigations increased. As there were more and earlier deaths in group D patients the number of investigations were correspondingly less. Many patients in Group B had associated respiratory burns. This was reflected in more blood gas analyses. (Table IX).

Blood investigations serve to monitor changes and early correction is mandatory in burns management. Otherwise when complications set in it will be more difficult to manage. It is essential therefore to anticipate and correct to normality the changes. Fluctuations in readings should ideally be avoided.

Table IX – Blood investigations frequency

Groups	A	B	C	D
Haematologic	14	22	68	25
Coagulation studies	4	5	19	6
Blood urea/electrolytes	5	10	33	10
Blood gases	4	12	6	12
Total	27	49	126	53

(g) Microorganism Profile

During the period of hospitalisation an average of 20 cultures were done per patient : 12 wound, 3 nasal, 4 blood and one urine. A total of 833 cultures were done in the 41 patients. Two-thirds (512 cultures) were positive for organisms whilst one-third (321 cultures) were negative. Positive cultures were grown from swabs taken from 35 wounds, 11 nasal, 10 blood and 8 urine cultures.

Microorganism profile of the patients serves to monitor the pattern and trend of infections within the patient's own body. It also serves to monitor the environment that the patient is treated in. In this study bacteriologic and fungal cultures were carried out. Two-thirds of the cultures were positive and this significantly assisted in modifying the treatment plan of the patients. This is especially so in relation to appropriate choice of antibiotics. Clinical input was necessary to determine whether the positive cultures indicated colonisation or active invasion of the organism.

Most of the cultures grew multiple organisms. The commonest organisms isolated were *Acinetobacter* species, *Pseudomonas* species, Methicillin Resistant Staph Aureus (MRSA) and *Staphylococci*. Fungal cultures were positive in 5 patients. The occurrence of positive fungal cultures during the latter parts of their hospitalisation reflected the pattern of organism colonisation and invasive infection. The frequency of organisms isolated is shown in Table X.

Table X – Frequency of organisms isolated

Organisms	No. of patients
Acinetobacter Sp	30
Ps Aeruginosa	25
MRSA	22
Staph Aureus	21
Strep Gp D	17
Enterobacter	14
Bacillus species	12
Klebsiella	9
Proteus	7
E Coli	5
Candida	5

MRSA: Methicillin Resistant Staph Aureus.

(h) Antibiotic utilisation

Our burn centre maintains a strict antibiotic policy. Routine antibiotics are not used. Antibiotics are started only when indicated based on clinical judgement or after investigation of an increased temperature. Antibiotics are given usually after a blood culture has been taken after a significant spike in temperature. Three set protocols for antibiotics are used.

When indicated, first line antibiotics consisting of crystalline penicillin/gentamicin/cloxacillin are used. Second line antibiotics include Amikacin and Unasyn and third line antibiotics utilisation is based on culture and sensitivity pattern.

Table XI shows the number of patients in the different group who were started on antibiotics.

Table XI - Antibiotic utilisation

Group	No. of Patients	No. started on antibiotics	1st line	2nd line	3rd line
A	24	13	10	3	–
B	7	6	1	4	1
C	3	3	–	–	3
D	7	5	–	5	–
Total	41	27	11	12	4

Of the 41 patients, 14 (34%) did not receive antibiotics. The remaining 27 (66%) were started on antibiotics. Eleven patients received first line, 12 patients received second line and 4 patients had third line antibiotics. Antibiotics were most commonly used in Group A patients who also had a better prognosis. In Group D patients often multiple antibiotics were used to treat infections with multiple organisms. The duration of first line antibiotic therapy ranged from 2-10 days, second line 2-20 days, third line 5-7 days.

(i) Dressings

Burn dressings are one of the most important components in burns management. These dressings serve to protect the wound, carry topical antibiotics and local medications to counter infective organisms and also to maintain a local environment conducive for wound healing. Generally superficial burns up to middermal in depth will heal with paraffin impregnated gauze (eg tulle gra). One advantage of using this early is that it affords easier and earlier assessment of the wound by a senior staff member. Application of the silversulphadiazine creams has the benefit of reducing gram negative organisms. Addition of chlorhexidine into the silversulphadiazine or paraffin impregnated gauze aid to reduce gram positive organisms from colonising the burn wound. Whilst other forms of burns dressings were practised in the unit, this review showed the four commonest dressings used to be tulle gra, tulle gra with silvazine, eusol paraffin/eusol and bactigra. Although the time and personnel required for each dressing was not quantified, a major burns dressing often required two to four trained nurses and it usually took one to two hours.

Bactigra which contained chlorhexidine was used when there was a positive wound culture for MRSA. Eusol and eusol paraffin dressings were used only on small localised areas of burns. Elase was only used once in a patient. Spenco and opsite dressings were used only in clean wounds of smaller extent of burns where it was possible to obtain a clear margin of normal skin for a complete seal and anchorage of the dressing. Irrespective of the size of the area dressed Table XII shows the type and frequency per patient.

Table XII – Dressing types and frequency

Type of Dressing	No. of times/per patient
Tulle gra (T/G)	3 – 14
T/G & Silvazine	7 – 16
EP/Eusol	5 – 21
Bactigra	8 – 29

DISCUSSION

Fire is known to have an impact on every civilisation. In Singapore we are fortunate to have three key agencies which are actively involved in gathering data to better understand the impact of fire on our lives and property. They are:

1) Singapore Fire Safety Bureau (SFSB)
2) Institute of Science & Forensic Medicine (ISFM)
3) Burns Centre, Singapore General Hospital (BCSGH)

The resultant effects on loss of human lives, injury and loss of property could be better understood when such data are available for cross correlation and comparison. This is particularly relevant in considerations for resource allocation. In a finite world, given the limited nature of resources available, one will have to properly balance issues related to burns prevention and burns treatment.

Moral and ethical issues are becoming[2,3] increasingly

important considerations as to who should be treated and how far the treatment should carried out. As doctors faced with these problems these decisions often are difficult to make. Ideally they should be unbiased. Decisions should be made on medical grounds rather than on age, sex, ethnic origin, occupation, religious background and political affiliations. This is very real as burn injuries may occur as a result of ethnic unrest and political protests. Value judgement for making such decisions could perhaps be guided when there are objective data available. Cost benefit analysis is one of the methods of clarifying some of the issues. However, it will not provide solutions[3,4]. Perhaps, as suggested by Centrewall[3] and Reeves[5], a political process may be required because the true cost of any service is what must be done without to make specific essential service available.

In an environment of limitations on treatment resources it is imperative to recognise that the moral responsibilities of individuals in the disciplines of public health are different from that of the individual health practitioners[6-8]. The former controls resources and defines the circumstances of care whilst the latter have to work within the theoretical possibilities and the practicalities in terms of available support systems and existing technology. It is recognised that this situation may occasionally develop into a stressful and emotionally laden standoff[6,7,9]. Compromises are required[10,11].

In situations relating to post traumatic injuries, cure is not the final goal to be achieved. Particularly in burns, the goals of the physician are limited to saving life, limb, restoring function, ameliorating morbidity and in our Asian context, "saving face" or cosmesis. Unfortunately, controlling morbidity is not always recognised as a major goal. Current challenges such a goal produces are limited only by the standards applied and the ultimate expectation and acceptance by the patient of the post-traumatic scar sequelae. One of the difficulties lie in deficiencies of our understanding of morbidity and its impact on economic productivity. Mortality is slightly easier to understand as it is a measurable phenomenon. Another concern is that some danger may arise as competition for scarce resource recommendations based on mortality will eclipse those relating to significant morbidity. Hence, firstly, in an attempt to take stock of our current situation this study has been conducted to ascertain in part the current logistics involved in acute burns care.

Secondly, although our current success in this cohort of patients showed a survival of 96.7%, a better indicator is the Lethal Area 50, a figure whereby 50% of the patients with a given extent of burns are expected to die. This concept, borrowed from the lethal dose 50 (LD50) in testing the toxicity of a substance, when applied to a burn treatment centre will give an estimate of the standard of burn care of that treatment centre. The estimated LA50 in our centre is around 70%. That is, half of our patients with 70% burns are expected to perish based on current standards of burns care in our centre. LA50 of some burn facilities are in the range of 95-99[12,13]. Amongst developing countries we are comparable. It is conceivable that their success in achieving such high survival rates are in part contributed by the role of advances in skin storage facilities and advent of biotechnology such as cultured and synthetic skin substitutes which are available in advanced centres. The review of this 1988 cohort of patients has been on individuals treated without the benefit of a skin bank nor the use of synthetic substitutes or cultured skin. Knowing our existing logistic support helps advance burns management as a specialised discipline for further development.

A third reason for reviewing the current logistics relate to the current and future needs of the Burns Centre. Useful and meaningful data for planning and effective management is often not readily available for a variety of reasons. In our attempt to better understand the total picture of resources management for burn care this study was undertaken. Such data become increasingly essential especially as our Burns Centre is serving a national role and particularly in having to handle mass burn disasters.

Fourthly, studies of such nature are not readily available even from reputed institutions abroad as such data is useful only from management's viewpoint rather than for pure scientific merit.

Fifthly, such logistic data will assist in planning and establishment of new burn units in countries that have yet to establish specialised burn treatment facilities. This is particularly so when the pattern of burn injuries is a reflection of the socio-economic position of a country.

Finally, from the standpoint of audit, it is preferable for in-house data to be available as data differ from institutions. This is particularly so when the philosophy, concept and management is so diverse between institutions managing burn patients. Hence the need for us to establish our own data.

From the 1988 Fire Data presented it can be seen that 50% of the fires from light thrown down (cigarettes, matches, papers) are avoidable. It is interesting to note that there was one burns admission for every 12 fires. Such data as far as the authors are aware is not available elsewhere.

The 1988 Burns Mortality Data presented showed one burn death in 55 unnatural deaths. We are fortunate to have a coroner to review all unnatural deaths in Singapore. Patients who die from burn injuries at the site or during transportation often sustain severe injuries. This has been shown in this study. Of those who reach hospital and eventually to our burns centre, most of those who died do so from the severity and extent of the injury. Those who survive long enough subsequently succumb to infection from septicaemia and bronchopneumonia, coagulopathy, severe metabolic derangement and multiorgan failure. Often several causes are present.

The 1988 Burns General Data presented showed 398 burns admissions. This figure has remained around four hundred admissions for subsequent years up to 1992. About three quarters (76.6%) were adults and a quarter (23.4%) were children. Children used to account for 50% of admissions in our Burns Centre. There has been an actual decrease in number and proportion of children admissions[14].

From the 1988 Burns Logistics Data presented it may be summarised that the more extensively injured and more seriously injured require more logistic support.

The extent and depth of injury are two of seven known factors that contribute to survival of burn patients. We know from a previous study[15] that the average length of stay (ALOS) for burns requiring fluid resuscitation regimes follow these guidelines:

one percent partial thickness burns requires
1 day hospitalisation

one percent full thickness burns requires
2 days hospitalisation

However, this is without guarantee of eventual survival although it is known that aggregate burn victims have an increasing chance of survival with each passing day[16].

From Tables IV and V, it is interesting to note that the average length of stay of groups A and B patients was around 18 days. However, more patients in Group A than Group B had relatively deeper injury.

CONCLUSION

In 1988 there was one death in every 314 fires. One burn admission occurred in every 12 fires. There was one burn death in every 55 deaths from unnatural causes. There were 15 burn deaths, two of which occurred at the site of injury. Of the remaining 13, seven died from suicidal burn injuries.

In the same year 398 patients (adults 76.6% and children 23.4%) were admitted to the Burns Centre. The sex ratio showed a male dominance of 3:1. Eighteen of the 305 adults admitted had pure inhalational injuries. The survival rate of this group of patients was 96.7%. The mortality rate was 3.3% and it was higher than the national baseline mortality rate of 1.9%. The three commonest aetiologic agents in 1988 were scalds 46.0%, fire 32.0% and explosions 11.0%.

The logistics involved in managing acute burns injuries were studied in a cohort of 41 patients whose injuries were severe enough to warrant fluid resuscitation regime. Group A patients constituted the largest group and their average length of stay was around 18 days. Group B patients showed that surgery was indicated in those with deeper injuries. A corresponding increase in minor surgical procedures was evident in this group. Group C patients had more extensive and deeper burns. This group received relatively more major operations for skin coverage. Group D, the most severe of the group required the most logistic support for their treatment. However, the data suggest that two of the seven patients in Group D died before the logistic supports were given.

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