OPINION

Burns injury: clinical features and management

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Introduction

Burn injury is a worldwide problem. It has plagued mankind from antiquity to the present day. [1] The method of treatment has undergone several metamorphoses. Numerous writings on burns date back to Hippocrates (460-377 BC). Even before that time the Egyptians in 1500 BC treated burns by incantation and a mixture of gums, goat hair, and milk from a woman who had given birth to a son. The Chinese and the Japanese used tinctures and extracts made from tea leaves (a fore-runner of treatment of burns by tannic acid). [2] Even Hippocrates had encouraged the use of iatrogenic burns for the treatment of other diseases similar to the use of burning the sole for the treatment of convulsion in the southern part of this country. [3] The multiplicity of treatment recommended for burns throughout history may well reflect the difficulties in management. This paper discusses the clinical features and management of burns injury based on the experience with burns injury in Zaria, Nigeria.

Clinical features

Burn injury is an emergency situation and patients usually report early in situation where Ambulance services exist. In our experience only 27% of the patient reported within 6 hours of injury in a retrospective review by this author. [4] Among children under three years of age only 25% were seen within 24 hours of injury. [6]

It is important to know the circumstances under which the burns occur as to guide one to the severity of injury and also the possibility of inhalation injury. Clothing burns is likely to be more severe in depth than scald injury. So also is petrol burn in which the victim clothing has been soaked. A temporary flash or temporary contact with hot metal would cause less severe injury (superficial burns) than prolonged contact with hot metal. Chemical burns and electrical burns cause severe injury usually third degree burns. The activities leading to burns as in our experience is shown in table 1. Hot pap or hot soup and a child sustaining burn injury with splashed hot oil from frying "Kose" (bean cake) is commoner than overturned kettle or teapot which produce superficial burns.

The age of the patient is very important as the very old (above age 65) and the very young below age 2 fair badly as they tolerate burns poorly and the mortality rate is very high even in the presence of limited burns. The mortality rate is low in those below the age of 50 and those with burned surface area smaller than 30%. As the extent increases above 30% the mortality rate increases among all age groups. (Tables 2 and 3). History of pre-existing diseases is noted. Those with epilepsy, cardio-respiratory metabolic disease, and associated injury should be recorded as these determine the severity of injury and prognosis.

Table 1: Features of burns in Zaria

Cause	No. (%)	Mean % BSA	Range % BSA
Scald			
Hot water	68 (33)	23	1 – 90
Soup/pap	7 (3)	21	1 – 42
Hot oil	6 (3)	17	8 - 45
Flame			
Fell into fire	28 (14)	20	2 – 45
Clothing fire	24 (12)	36	9 – 90
Petrol fire	20 (10)	53	23 – 100
Kerosene fire	16 (8)	39	10 – 98
House fire	14 (7)	42	12 – 85
Bedside fire	6 (3)	23	6 – 35
Burning vehicle	6 (3)	35	7 - 72
Others			
Electric	3 (1)	15	18 – 20
Gas fire	2 (1)	65	-
Chemical	1 (0.5)	43	-
Insecticide	1 (0.5)	85	-
Not stated	5 (2)	-	-
Total	207 (100)		

Table 2: Age and outcome of burns injury in Zaria

Age (Yrs)	Total No.	Discharged	Died	Absconded	Transferred	Not stated
1 – 20	100	78	5	14	2	1
21 – 40	62	29	27	5	1	-
41 – 60	19	2	17	-	-	-
61 – 80	8	1	7	-	-	-
81 – 100	14	-	14	-	-	-
Not stated	4	2	2	-	-	-
Total	207	112	72	19	3	1

Management

Generally speaking, the initial management of burn injury starts at the site. In our experience the first medical attention the patients gets is in the hospital.

Immediate Care (First aid measures)

1. Remove the patient from the source of heat and extinguish flames. If the cloth catches fire patient should rollover several times rather than running all over the place, which fans the fire.
2. Apply cold clear water soaks to affected areas and renew these every 3 minutes.
3. Electrical burns usually cause severe injury - electrothermal, making ignition or electrocution. Switch off electrical supply. The victim if unconscious exclude the presence of cardiac arrest and if necessary start cardio-pulmonary resuscitation.
4. In case of chemical burns - irrigate copiously by the affected part with clean water. In case of phenol burns, use polyethylene glycol. With acids or alkalis

irrigate with water until litmus paper placed on the skin no longer reacts.

5. Patient should be transported immediately with great care. A secure intravenous line is required for major cases. The burns should be covered with clean sheets and the patient wrapped in warm blankets.

Hospital care (General evaluation and treatment)

1. General evaluation of the patient is done rapidly and systematically. Maintenance of a patent airway and ensuring adequate breathing is a priority.
2. If not done at site of the accident, intravenous line is established using a large vein.
3. Indwelling urethral catheter is inserted.
4. The use of central venous line or any invasive procedure is avoided as much as possible except in patients with risks of fluid over load.
5. The patient is weighed.
6. Assess extent and depth of injury.
7. Detailed history is taken including the circumstances under which the burns occurred.

Fluid replacement

This is the most important aspect of the initial management once the airway is maintained. As soon as the extent of injury is determined as well as weight and depth and the time between injury and arrival in the hospital are known, the amount of fluid to be replaced is calculated.

Early fluid replacement prevents shock, which is one of the lethal complications of burns. In Zaria, either Ringer's lactate or normal saline is used. [9] The formula commonly used in this centre for estimation of fluid requirement is the Parkland. In this formula crystalloid is used during the first 24 hours. It is popular in Zaria since it does not employ the use of plasma or other colloids, which are scarce. Other formulas in use are the Evans formula, the Muir and Barclay formula and the Brooke formula. These formulas employ the use of colloids in addition to crystalloid during the first 24 hours. The Muir and Barclay formula gives an estimate of fluid requirement to cover the first 36 hours. Using the Evans formula for example, the fluid requirement for the first 24 hours for adult is given as the sum of the following three fluid volumes. [9] Adequacy of the fluid resuscitation can be guided from the urine output, which should be at least 35-50mls per hour in adult or 1.2ml/kg/hour in children.

Table 3: Mortality: age and extent of burns

Age (Yrs)	%BSA						
	0 – 20	21 – 40	41 – 60	61 – 80	81 – 100	Not stated	Total
0 – 4	3	14	10	3	1	1	32
5 – 9	1	3	-	1	1	1	7
10 – 14	-	-	-	1	2	-	3
15 – 19	-	-	-	1	1	-	2
20 – 24	1	-	1	-	1	-	3
25 – 29	-	3	2	1	2	-	8
30 – 34	-	2	-	-	3	-	5
35 – 39	-	-	-	-	1	-	1
40 – 44	-	-	1	-	-	-	1
45 – 49	-	1	1	-	-	-	2
50 – 54	-	-	-	-	-	-	-
55 – 59	-	2	-	-	-	-	2
60+	-	2	-	-	1	-	3
Not stated	-	-	2	1	-	-	3
Total	5	27	17	8	13	2	72

Table 4: Burn wound bacteriology in Zaria

Isolates	No.	%
Staphylococcus	46	36.5
Proteus mirabilis	25	19.8
Pseudomonas aeruginosa	21	16.7
Klebsiella species	13	10.3
β haemolytic streptococcus	7	5.8
Escherichia coli	6	4.8
Acinetobacter	1	0.8
Providentia	1	0.8
Others	6	4.8
Total	126	100

Table 5: Further burns wound bacteriology

Isolates	No.	%
Pseudomonas aeruginosa	15	26.8
Staphylococcus aureus	14	25.0
Klebsiella	11	19.6
Escherichia coli	3	5.4
Others	13	23.3
Total	56	100

Wound care

After the stabilisation attention is paid to the wound. General management includes the use of analgesics in the form of intravenous morphin or pethidine given only after adequate volume replacement. In addition, tetanus toxoid is also given in the non-immunized patient. Human anti-tetanus gamma globulin 250-500 units is given. Immunisation thereafter is completed using the routine dosage schedule. In some units cloxacillin or ampiclox are routinely used as prophylaxis against the spore-forming organism, particularly tetanus. When infection becomes established, the organism is identified from culture, its sensitivity determined and appropriate antibiotics given. [7,8]

The wound is cleaned in the emergency ward or in the theatre. Loose skin is removed and sterile dressings applied. In Zaria, Vaseline gauze or sufratulle is used next to the burned skin in addition to the gauze. [10] In advanced countries, surgical detergents are used for cleaning. Initial debridement could be done in the Hubbard tank with subsequent cleaning in the Hubbard tank or shower depending on the patient's general status and the location of the burn. The decision to use either a closed or open method is dependent on the site of injury, the choice of the surgeon and the facilities available. In Zaria, the open method has been employed as appropriate in both children and adult. The cool dry harmattan with its low relative humidity favours the exposure method of treatments. [10, 11] The site of injury should also be taken into consideration in deciding which method of treatment. For example, burns of the Head and Neck, the perineum and non-circumferential burn of the trunk can be treated by the open method while circumferential burns of the trunk and limbs as well as toes and fingers can be treated by the closed method. In the exposure method, antibiotic sprays such as polybactrim or cicatrin is used.

The use of topical antimicrobial agents has revolutionised the local management of wound. The topical agents in use are sulfamylon, silver nitrate (0.5%) solution, silver sulphadiazine (flamazine -Smith and Nephew, UK). These agents are effective against most of the gram-negative organisms. Sulfamylon cream prevents pseudomonas burn wound sepsis and penetrates the eschar very well. It is a carbonic anhydrase inhibitor and cause acidosis due to bicarbonate wastage by the kidneys. When this occurs the drug usage is stopped until the condition reverses. The agent produces considerable pain upon application in over half of patients. Because of these disadvantages, sulphamylon cream is no longer used. [7] Silver nitrate solution though messy because the dressings must be soaked frequently, can also be used. The sulphamylon and silver sulphadiazine creams can be used alternatively in 12 hours to reduce the side effects of each drug while taking advantage of the superior gram-negative activity of the former and the anti-candida activity of the later. Escharotomy or escharectomy is sometimes necessary on the limb or trunk when eschar is likely to cause a compartment syndrome. The effect of prompt eschar excision and immediate wound closure has been studied at the Massachusetts General Hospital. This was proved to have reduced overall mortality over the 9.5 year period. [1]

Excision of the burn wound with immediate skin graft coverage may shorten hospital stay reduce the risk of burn wound infection, and decrease the severity of stress, which is proportional to the extent of the burn. Against these potential advantages must be weighed against the adverse effects of excisions, which include anaesthetic risk and the operative stress associated with what can be prodigious blood loss when excisions of burns of more than 20% of the total body surface are carried out as a single procedure. This is important because we do not have large quantities of blood, and therefore this requirement would limit its applicability in our environment. Uncomplicated superficial partial thickness burns usually heal in 14-21 days. If this does not happen, it is likely to be a third degree burn. In this case, the eschar is allowed to separate and healthy granulation tissue is later grafted. Commonly autogenous graft is used here. The separation of the eschar can be hastened by excision and the surface treated by using topical and oral or systemic antibiotics before grafting.

Nutrition

The patient needs nutritional support. In severe cases, intravenous feeding may be necessary in the form of total parenteral nutrition or at least a high protein or elemental diet orally. A 60kg man with 50% burns may need 120-180gm of protein daily. High carbohydrate intake is also required. This is supplemented by multiple vitamins. In children and anorexic patients nasogastric tube feeding may be employed. [10] The patients can be weighed daily and later twice weekly. Serum protein measurement may be done regularly to monitor nutritional improvement.

Respiratory injury

Respiratory tract injury is either due to direct damage by steam or hot air which is limited to upper respiratory tract, or smoke which may contain various chemicals or gases such as carbon monoxide or sulphur dioxide which are thought to be the leading cause of death among victims of fire in a closed space. [7] Identification of this problem during clinical examination is essential in order to institute appropriate therapy. In such cases, early administration of oxygen and monitoring of blood gases would help in the management of the victim.

The use of three newer modalities has enhanced the timeliness and reliability of the diagnosis of inhalation injury. ^{133}Xenon ventilation perfusion pulmonary scinti-photography, fibreoptic bronchoscopic examination and pulmonary function testing. The xenon lung scan is performed after haemodynamic stability is achieved but before post-burn hyperventilation reaches significantly elevated levels (usually beyond 72 hours post burn). Serial scinti-photographs are obtained following the injection of 10 microcurie of ^{133}Xenon into a peripheral vein. Unequal radiation density and the retention of the gas in the lungs beyond 90 seconds post-injection are considered positive indications of inhalation injury. [1] Fibre-optic bronchoscopy can be done at the bedside as soon as the patient is Haemodynamically stable.

At the present time we do not have these facilities in Zaria. We depend on clinical suspicion. The leading clinical information includes, burns in a closed space, head and neck burns with the singeing of the nasal vibrissae as well as those burned under drug overdose or head trauma leading to impaired mentation. Other signs include a brassy cough, hoarseness and wheezing, bronchorrhea and unexplained hypoxaemia and the production of carbonaceous sputum. All these signs may not be evident till 2-3 days post-burn. The second post-burn day has been the mean time of diagnosis of inhalation based on the presence of such clinical signs. Management of this complication includes the administration of warm, humidified, oxygen-rich air. Endotracheal intubation may be required in progressive hypoxaemia. Steroid therapy is reserved for intractable bronchospasm. Bronchopneumonia is a complication of inhalation injury and a frequent cause of morbidity and mortality. Bronchial cultures should be obtained and systemic antibiotics given.

Morbidity and mortality

Hypovolaemic shock is the commonest and most

dangerous complication of severe burn. [7] However, this is now largely preventable by early and prompt fluid resuscitation. Fluid resuscitation is best begun as soon as possible after injury in all patients with burns of 15 percent or more of the total body surface. [1, 2] The goal of resuscitation is the maintenance of vital organ function at the least immediate or delayed physiologic cost. This can be achieved by using a balanced salt solution for fluid replacement during the first 24 hours post-burn. The quantity to be infused in the adult has been estimated to vary between 2 and 4 ml/% burn/kg body weight. To prevent overloading one can start with 2ml at the initial state increasing the infusion only if necessary. [1] In this centre Ringer's Lactate or normal saline is the commonest fluid used in the early resuscitation of the burn patient. [10, 11]

Infection of the burn wound is a preventable but most common complication. The patient is initially infected by skin flora, which later change to more serious gram-negative bacteria after the 4th day. [13] The commonest organisms are the staphylococcus aureus, and, the gram-negative enterobacteriacea. In a retrospective study by the Author in Zaria staphylococcus aureus was found to be the commonest organism (Table 4). Others are proteus mirabilis, Escherichia coli, and in a later study pseudomonas was found to be the commonest organism (Table 5). In a study of the bacteria in burns at Lagos University Teaching Hospital by Coker et al, pseudomonas aeruginosa (27.9%) was the most common organism isolated. [11] Others included Staphylococcus aureus 22.4% Klebsiella species 11.0%, E. Cole 10.6%, and Proteus species. On the whole, 66.7% were gram-negative organisms and 32% gram-positive organism, most were found to be sensitive to gentamicin and the gram-positive were 100% sensitive to cloxacillin.

The morbidity of the burn injury and also the mortality are related to the extent of burns, and age of the patient. The larger the percentage of the body surface burned the greater the risk of shock and probably infection as well as increase in hospital stay.

Burns above 50% have probable mortality, which may reach 50% or more. [2, 7] The greater the extent and depth the more the need for blood transfusion and the development of infection as well as later contracture. Those above the age of 55 years and those below the age of 12 months tolerate burns poorly and the mortality rate is very high even in the presence of limited burns. [2] In general, the mortality rate is low in those below the age of 50 and those with burned surface area smaller than 30%. As the extent increases above 30% the mortality rate increase among all age groups. [2]

The outcome of management depends on pre-existing disease. Those with cardio-vascular or renal disease may have a bad prognosis especially for overcoming the shock state 2,8. The presence of epilepsy, mental illness and alcoholism worsens the prognosis. The part of the body affected is also very important. Burns of the face, eye, mouth, and ear are also of significant importance in morbidity, as well as burns of the hands, feet, joint surface and the perineum.[2]

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