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YETUNDE A. AKEN'OVA

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A. O. OGUNNIYI

O. D. OLALEYE

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Thermal injuries in under - 4 year old children: the Lesotho experience

AMO Shonubi¹, O Akiode², AA Musa², BA Salami², HA Kingu¹, and P Mohaleroe¹
Queen Elizabeth II Hospital¹, Maseru, Kingdom of Lesotho and Olabisi Onabanjo University
Teaching Hospital², Sagamu, Nigeria

Summary

The Queen Elizabeth II Hospital is the apex of the health care services in the Kingdom of Lesotho but has no designated burns unit. A review of patients managed during a 5-year period was done to document our experience so as to show what can be achieved even without a standard burns unit. We reviewed the clinical course of children who were admitted for care of acute thermal injuries during a 5-year period, May 1997 to April, 2002 inclusive. All were treated in the children surgical ward in accordance with a protocol of care emphasizing urgent care of shock, accurate fluid therapy, open wound care and early enteral feeding. Ninety-eight children (51 males and 47 females) aged 4 months to 43 months (mean 21.66 ± 11.30 months) were admitted on account of acute thermal injuries during the study period. The injuries included scalding (46%) involving predominantly the upper part of the body and full thickness burns (87%). Skin grafting was needed in 82% of the patients. The common complications were infection, fluid imbalance, respiratory problems, and contracture deformities. The mean duration of hospital stay was 40 ± 4.43 days and the case fatality rate was 9%. The case fatality rate in this series is considered high and could be improved if there were a well staffed specialized burns unit.

Keywords: Thermal injuries, scald, burns, children.

Résumé

L'hôpital de la Reine d'Elizabeth II est le garant des services de soins sanitaires dans le Royaume de Lesotho mais n'a aucune unité désignée de brûlures. Une révision de malades gérés pendant une période de 5 ans a été faite pour documenter notre expérience pour pouvoir montrer ce qui peut être accompli sans même une unité des brûlures standard. Nous avons examiné le traitement clinique des enfants qui ont été admis pour des soins de blessures thermiques aiguës pendant une période de 5 ans de mai 1997 à avril, 2002 inclus. Tout ont été traités dans le service chirurgicale des enfants conformément à un protocole de soin qui mettait l'accent sur les soins d'urgents de choc, une thérapie précise de fluide, les soins de blessures ouvertes et l'alimentation entérique précoce. Les quarante-huit enfants (51 mâles et 47 femmes) âgés de 4 mois à 43 mois (moyenne 21.66 ± 11.30 mois) ont été admis à cause de blessures thermiques aiguës pendant la période de l'étude. Les blessures incluaient l'ébouillantage (46%)

impliquant la partie supérieure du corps et de manière prédominante l'épaisseur totale de la brûlure (87%). Une greffe de la Peau était nécessaire dans 82% des malades. Les complications communes étaient l'infection, le déséquilibre de fluide, les problèmes respiratoires, et la difformité de la contracture. La durée moyenne de séjour à l'hôpital était 40 ± 4.43 jours et le taux de mortalité du cas était 9%. Le taux de mortalité de cas dans ces séries est considéré plus élevé et pourrait être amélioré s'il y avait une unité des brûlures spécialisée pourvu de personnel.

Introduction

Accidents including thermal injuries in children are a fairly common occurrence. In Britain, it accounts for about 17% of hospital admissions for children and about 12% of deaths following accidents in young children [1,2]. Such injuries occur predominantly in the first three years of life and, although a high proportion are not extensive in terms of body surface area, the metabolic and systemic disturbance are relatively greater in the younger than in the older children [2].

Recent studies have identified age below four years as an independent risk factor for mortality in children with thermal injuries. Erickson *et al* [3] and Morrow *et al* [4] observed that children below 4 years of age with burns affecting more than 30% of the body surface, had a mortality rate that is more than double that of older children with similar injuries. Thus, an awareness of the essential differences in the management of young children and modifications of the plan of treatment used for older patients are needed if problems are to be avoided [5].

Survival rates after burns have improved significantly for children. At present, most children, even young children managed in designated burns units survive [6,7]. The Queen Elizabeth II Hospital is the apex of the health care service in the kingdom of Lesotho but has no designated burns unit. Thus, a review of patients managed during a 5-year period was done to document our experience.

Patients and methods

In the five-year period May, 1997 to April, 2002 inclusive, one hundred and twenty-seven children aged under fourteen years were admitted to the children surgical ward of the Queen Elizabeth II Hospital, Maseru, Kingdom of Lesotho with scald and burn resulting from thermal injuries. The patients were aged between 4 months and 13 years. Ninety-eight (77%) of them who were aged less than 4 years formed the subjects in this review. Fifty-one (52%) of the patients were male; one (1%), the son of a nursing sister in the hospital had sustained previous burn injuries.

The protocol adopted for the treatment of a thermally injured child in the hospital included: urgent care of shock, and respiratory distress, assessment of percentage body surface area (BSA) injured, using a chart adapted from Lund and Browder's measurements for relative body surface areas in childhood [8], and intravenous fluid resuscitation administered in accordance with the Mount Vernon formula [9]. In addition, 1% silver sulphadiazine cream (flamazine) was applied to all injured areas except the face, and exposure without dressings whenever possible was practised. The vital signs that is, temperature, pulse rate and respiratory rate as well as urinary output were regularly monitored. Burn wound site was routinely swabbed twice weekly for bacteriologic culture. Anaerobic culture was not routinely done. Others included repeated urine analysis for microscopic and bacteriologic abnormalities as well as specific gravity, osmolality and glucose; determination of serum urea, electrolytes, glucose and full blood count including haemoglobin two to three times a week; early enteral feeding with a relatively high protein, high caloric mixture given by nasogastric tube if necessary. Split thickness skin grafting by a single autograft procedure was undertaken after separation of slough and formation of healthy granulation tissue or, less frequently following early excision of slough.

Results

The ninety-eight under 4-year old children with thermal injuries comprised 51 males and 47 females (M: F = 1:1). They were aged between 4 months and 43 months (mean 21.66 ± 11.30 months). Most of the patients (46%) were in the second year of life. One patient, an 18-month old son of a nursing sister in the hospital had sustained previous burn injuries.

Table 1: Cause of thermal injuries in 98 children

Causes	No (%) of patients
Porridge	39 (40)
Water	32 (33)
Dry heat (Paraffin)	14 (14)
Dry heat (Cow dung)	7 (7)
Fat	6 (6)

Nature and severity of injury

The causes of thermal injuries are shown in Table 1. Forty-five percent (45%) of the injuries were scalds and 87% were deep burn. All the injuries occurred as domestic accident. The distribution of the injuries (Table 2) was predominantly in the upper part of the body. The extent of injury as percentage BSA in relation to mortality is shown in Table 3. Ninety patients (92%) had over 10% BSA burn. The largest BSA involved was 87%. Full thickness skin loss occurred in some parts of the injured area in 85 patients (87%). In seven patients, the area was small enough to allow healing without grafting.

Table 2: Parts of body involved with thermal injuries in 98 children

Anatomic part of body injured	% of patients
Face	15
Neck	13
Chest	37
Trunk	38
Upper limbs	45
Lower limbs	19

*Some patients had more than one anatomic part injured.

Table 3: Percentage BSA involved with thermal injuries in relation to mortality in 98 children

% BSA	No. (%) of patients	No. of deaths (%)
Less than 11	8 (8%)	0 (0%)
11-20	26 (27%)	1 (4%)
21-30	27 (28%)	2 (7%)
31-40	22 (22%)	2 (9%)
More than 40	15 (15%)	4 (20%)
Total	98 (100)	9 (9%)

Management

Eighty-seven patients (89%) required intravenous fluid resuscitation with saline and/or colloid. Colloid infusion was only continued beyond 36 hours on clinical indications in some patients.

Operation

Eighty-one patients (83%) underwent excision of slough and split thickness skin grafting, 65 had only one operation while the rest (16) had more than one operation because of the large area that needed to be grafted. Over 80% of first skin grafts were adequate. The incidence of infection complicating the skin grafting was not significantly different between patients undergoing one operation or multiple operations. The average duration of stay in hospital was 40 ± 4.43 days.

Table 4: Percentage of burn injuries from which each organism was cultured.

Organism	%
Staphylococcus aureus	60
Staphylococcus albus	51
Streptococcus pyogenes	10
Streptococcus faecalis	27
Escherichia coli	12
Proteus mirabilis	5
Pseudomonas aeruginosa	4
Other organisms	Each less than 1

Complications

Swabs taken from the wound area within 72 hours of admission did not grow any organism in 86 patients (88%). Table 4 shows the variety of organisms subsequently cul-

tured from wound swabs. *Staphylococcus aureus* was the most commonly cultured organism (60%). Wound swab remained negative in 12 patients (14%).

In 33 patients, burn wound infection alone was diagnosed based on clinical evidence of infection at the wound site and systemic disturbance. There was no clinical sign of infection at other sites. Fifteen patients had respiratory infection clinically and confirmed in some cases by chest radiograph. Eight patients had septicaemia with positive blood culture; *Escherichia coli* and *Staphylococcus albus* were the isolated organisms in 3 patients each and *Staphylococcus aureus* in 2 patients. Six patients had urinary tract infection with positive urine culture.

Nineteen patients (19%) developed complications other than infection. These included fluid imbalance in seven patients (7%) who either received insufficient fluid (2 patients) or excessive fluid (5 patients). Three patients developed fixed, flexion deformities of the elbow joints, acute renal failure occurred in two patients with extensive burn and, paralytic ileus occurred in one.

Nine patients (9%) died. The causes of death in these patients were septicaemia (6), acute renal failure resulting from fluid and electrolyte disturbance (2) and respiratory complications (1). The mean survival from the time of injury to death was 27.0 ± 15.26 days (range 3-47days). The mean stay in hospital for all patients was 21.03 ± 23.17 days (range 3-97days); for those undergoing surgery for deep injuries, the mean hospital stay was 40 ± 4.43 days (range 17-97 days).

Discussion

The peak incidence for thermal injuries in our study is in the second year of life. This corresponds to a time of increased mobility and activity by the child. Furthermore, all the injuries expectedly occurred as domestic accident. However, unlike the male preponderance in other studies [2,10], the male-female ratio in the present study is 1:1. We are of the opinion that both sexes at this age are equally active and inquisitive hence they are equally prone to domestic accident. Furthermore, there was no case of non-accidental injury in our study unlike in other reported series [2,10]. Perhaps, this is due to the fact that non-accidentally injured children are often not brought to the hospital in our environment.

An accurate estimation of the BSA injured viz-a-viz changing body proportions with age requires the use of specialized charts [8]. Some "minor" (<10%) injuries were admitted because of the location of the injuries in the upper part of the body, the young age of the children, the depth of burn, the need for skilled nursing care and the social circumstance of the family. Indeed, it has been suggested that there may be good reason for reducing further the rather arbitrary (10%, BSA) distinction between "minor" and "serious" injuries in the first year of life [2]. Majority of our patients had intravenous fluid administration, as it has been found that small children benefit from

intravenous fluids even for relatively small burn areas [2]. Fresh frozen plasma was used, though less effective than reconstituted freeze-dried plasma in maintaining plasma globulin level and resistance to infection [11] because it was more readily available and satisfactory as a blood volume expander. Intravenous crystalloid solution was given in addition to plasma to maintain hydration. Adequate nutrition was maintained in all the patients by early enteral feeding.

Silver sulphadiazine (flamazine) was routinely used in the open dressing of the burn wound in our patients because of its painless application, soothing effect, restriction of fluid and heat loss from the burn surface and promotion of healing. This has also been the experience of other workers [2,12]. Although Jarrett *et al* [13] reported leucopenia following the use of silver sulphadiazine, none of the patients in the present study had leucopenia. The bacteria isolated from the burn wounds were mostly aerobic. This reflects the fact that few injuries occurred around the oral region, and also in most cases we could not culture for anaerobic organisms. In spite of the exposure treatment, cubicle nursing and restricted use of antibiotics a few pseudomonas organisms were cultured. Burn wound cultures though monitored to guide selection of appropriate antibiotics when needed, the incidence of invasive infection was still high. This is similar to the findings in the study at the Wesley Guild Hospital, Ilesa, Nigeria [14].

Infection, other than wound infection, is a major cause of morbidity and mortality in burn injuries. Sixty-two patients (63%) developed infections and of these, septicaemia (in 8 patients) were clearly due to invasive burn wound sepsis. In the absence of airway injury, we could not ascertain in this study whether the respiratory tract infection (in 15 patients) was haematogenous from the burn wound or was principally a bronchopneumonia due to inhalation of retained airway secretions. Burn wound sepsis with pyrexia and leucocytosis was not associated with secondary infection in 33 cases: appropriate antibiotic therapy based on known cultures was given in each case. Oyelami *et al* [12] in a recent study found that daily soaking of burn wound patients in warm normal saline prior to dressing significantly reduced the incidence of burn wound infection. It has been suggested that a high index of suspicion should be maintained for respiratory complication, as the appropriate treatment demands early and careful assessment [15]. Certainly, following smoke inhalation and severe burns of the face and glottis, endotracheal intubation, and mechanical ventilation may be needed as such injuries increase the risk of pulmonary infection [16].

In one patient, evidence of congestive cardiac failure resolved rapidly following restriction of intravenous fluids but two other babies died. Fluid imbalance resulted from a combination of factors, which included incorrect assessment of burn area, delay in establishing intravenous infusion and inaccurate regulation of the infusion rate. In no case did fluid imbalance develop following initial timely and appropriate intravenous fluid therapy. It is

known that the combination of overestimation of burn area, fluid requirement and an acute renal injury due to shock imposes particular strain on the cardiovascular system [2].

Our practice of allowing slough to separate spontaneously before a single auto graft procedure resulted in fewer operative procedures, less restriction of the activity of the young patient, less metabolic disturbance, and fewer blood transfusions than would have been the case with early excision and grafting. The advantages of early excision and grafting however are less risk of infection, less burn wound contracture, and shorter stay in hospital [17], but these benefits could not be ascertained in the present study because of our practice.

Similar to findings in other reports [2,4,7,12] septicemia, fluid and electrolyte disturbance (probably in association with renal complications), and respiratory complications contributed to the mortality in this series. However, our case fatality rate (9%) is considered high compared with case fatality rate of 1-6% from other studies [10,18,19]. The principal factors that could explain the high mortality in this series include the high complication rate and inadequate facilities available for the management of the patients in our unit. However, the relatively long mean survival of 27 days from the time of injury to death in this study compares with a mean survival of 23 days in a review of 115 deaths by Linares [19].

The care of thermal injuries in childhood has long received much specialized attention, but recently the concept of the care of the whole child has been thoughtfully enunciated [20,21]. Even without a specialized burn unit some degree of success can be achieved by a paediatric unit in cases of paediatric burn trauma following the care of the whole child.

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