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Burns in Children at University Hospital of Brazzaville

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Abstract

Introduction: Burns represent one of the five major traumatic emergencies in children and are responsible for significant morbidity and mortality. We conducted this study to describe the diagnostic and therapeutic aspects of burns in children in our setting. **Patients and Methods:** This was a descriptive cross-sectional study, conducted from June 2021 to May 2023, in the burns unit of the Brazzaville University Hospital. It focused on children aged 0 - 18 years hospitalized with a burn injury. **Results:** We had identified 122 cases of burns. There were 62 boys and 60 girls, giving a sex ratio of 1.03. The median age was 2 years. Most of the burns were accidental in 94.2% of cases and occurred in the home in 97.5% of cases, 52.5% of them in the kitchen. They were often thermal due to scalding (68.9% of cases). The burns were most often on the limbs and trunk (69.7% and 68.8% respectively); the average burned skin surface was 22%. The majority of cases were superficial 2nd degree burns in 79.2% of cases. Treatment was based on fluid and electrolyte resuscitation and local care for recent burns and infection control for old burns. **Conclusion:** Burns in children are a frequent emergency in our practice. They most often affect young boys of pre-school age, from low socio-economic backgrounds. These children are frequently exposed to heat sources by accidental scalding. The morbidity and mortality associated with burns in children remain a major health problem. Preventive measures are the most effective way of reducing the incidence and complications of this condition.

Keywords

Burn, Scalding, Child, Brazzaville

1. Introduction

A burn is the destruction of the integument, or even the underlying tissue, by the action of a thermal, chemical or electrical agent, or ionizing radiation [1]. It is responsible for a wide range of physical, aesthetic and psychological damage. According to the World Health Organization (WHO), 11 million people worldwide suffered burns in 2004, and almost a third of these were children aged 0 - 5 years [2]. Burns represent one of the five major traumatic emergencies in children and are responsible for a significant morbidity and mortality rate, estimated at 39% [3]. Prevention, diagnosis and management of burns are therefore hampered by a lack of strategies and recommendations [4]. We conducted this study with the aim of describing the diagnostic and therapeutic aspects of burns in children in our practice.

2. Patients and Methods

It was a prospective observational study, carried out from June 2021 to May 2023, *i.e.* over a period of 2 years, in the burns unit of the orthopedicstraumatology (OT) department and the pediatric intensive care department of the Brazzaville University Hospital. We included in our study children of both sexes, aged 0 - 18 years, hospitalized with a burn injury. The variables studied were:

- epidemiological: frequency, sex, age divided into 3 groups: under 5 years, 6 - 10 years, 11 - 18 years, origin; parents' age, level of education and socio-economic status.

  Socio-economic status was divided into three categories [5]:

- **Higher level**

  Senior corporate executives.

  Self-employed professionals (doctors, lawyers).

  Business owners and people living off their investments.

  Very high incomes and higher education qualifications.

- **Middle level**

  Middle managers and senior civil servants.

  Engineers and skilled technical professionals.

  Office staff and technicians.

  Traders and craftspeople.

- **Level lower**

  Skilled and unskilled workers.

  Service staff.

  People in precarious circumstances or unemployed.

- diagnostic: history, time to consultation, circumstances of onset, topography, depth, surface area using the Lund and Browder table [6] divided into less than 5%, 5 to 10%, 11 to 20%, greater than 20%;
- therapeutic: pre-hospital management, therapeutic methods, intensive care unit stay;
- outcome: length of hospital stay, complications, lethality.

  Data were collected using Excel and then analyzed using Windows 4.2.1. Qual-

itative variables were presented as headcount and percentage, and quantitative variables as mean ± standard deviation or median with quartile.

3. Results

3.1. Epidemiological Aspects

We identified 187 burn patients, 133 (71.1%) of whom were children and 54 (28.9%) adults. We selected 122 cases for our study.

The annual incidence was 61 cases of burns in children per year. There were 62 (50.8%) boys and 60 (49.2%) girls, giving a sex ratio of 1.03. The median age was 2 years, with quartiles of 1.1 months and 5 years (Table 1). Burns occurred in preschool children in 92 cases (75.4%). Schoolchildren accounted for 24.6% of cases. The frequency of burns was inversely proportional to age.

The average age of fathers was 39 ± 8 years, with extremes of 26 and 62 years. That of the mothers was 31.3 ± 7.3 years with extremes of 20 and 56 years. 71 (58.2%) parents had primary education and 27 (22.1%) secondary education. 114 (93.5%) fathers and 55 (79.7%) mothers were employed. Most of the children with burns came from a low socioeconomic level with 71 cases (58.2%).

We noted a predominance of cases of burns during the cooler seasons.

The majority of burns were individual with 118 (96.7%) and 4 (3.3%) were collective.

In our study, 115 (94.2%) children suffered a burn accidentally and 7 (5.8%) intentionally.

In 119 (97.5%) cases, the burns occurred most often at home. The kitchen was the room where the majority of burns occurred (Figure 1).

Two children (1.7%) suffered burns in the neighborhood and 1 (0.8%) on the public highway.

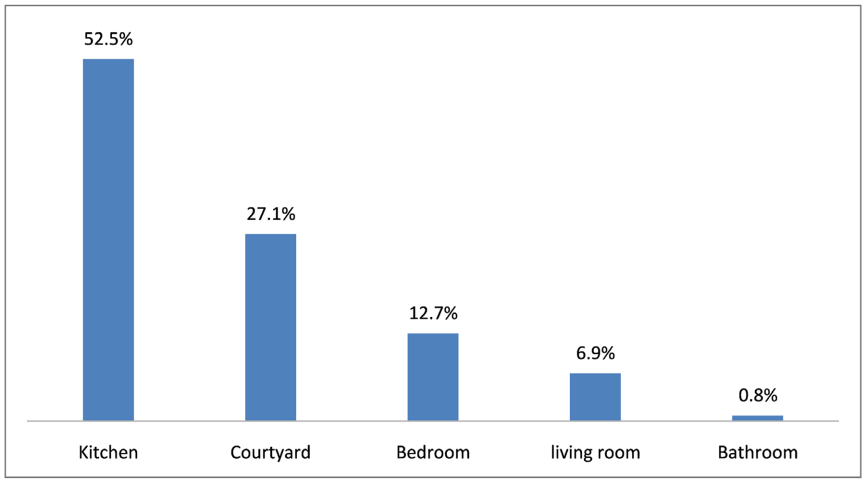


Figure 1. Distribution of patients according to where the burn occurred.

The causal agents found were thermal in 120 (98.4%) cases and electrical in 2 (1.6%) cases.

Table 1. Distribution of patients by mechanism of the burn.

Mechanism	N	%
Scalding	**84**	**68.9**
Flame	14	11.5
Hot contacts	08	6.6
Unknown	01	0.8
Not specified	15	12.2
Total	**122**	**100**

3.2. Flame: Thinners (Petroleum, Diesel, Petrol), Wood, Leaf

The person responsible for the burn was the victim in 86 cases (70.8%), a third party in 24 cases (19.2%) and 12 cases (10%) unknown.

Consultation time ranged from 1 hour to 1 month, with a median of 2 hours (1 - 24 hours); however, 68 (55.7%) children consulted before the 6th hour.

3.3. Diagnosis Aspects

- **Clinical General condition**

- Consciousness was preserved in 117 (95.9%) children; 5 (4.1%) children were unconscious on admission.
- 117 (95.9%) children were hemodynamically stable on admission and 5 (4.1%) children were admitted in shock.
- 48 (39.3%) children were febrile, and 74 (60.7%) children were apyretic.
- 86 (70.5%) children had good hydration status and 36 (29.5%) children were dehydrated.
- on arrival, 30 (24.6%) children were malnourished and 92 (75.4%) children had a good nutritional status.

3.4. Burns Aspects

- Burns were most often located on the limbs and trunk (Figure 2, Figure 3).

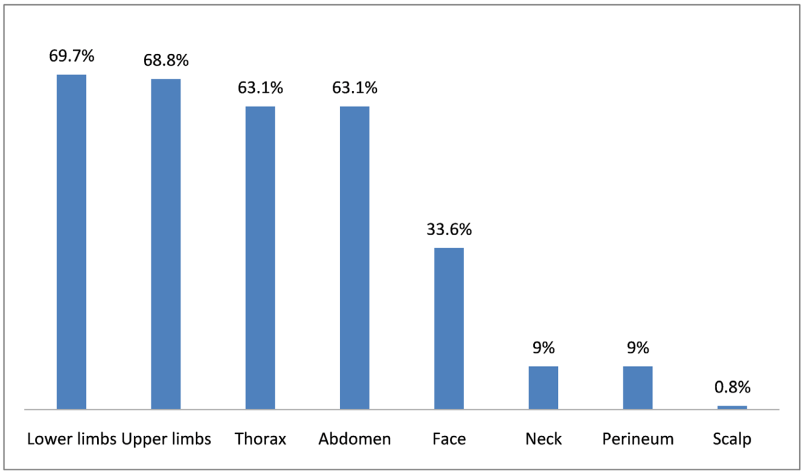


Figure 2. Distribution of patients according to burn topography.



Figure 3. Superficial second-degree burn in a 20-month-old infant.

- The average burned skin area was 22%, with extremes of 2 and 99%.
- The majority of cases were superficial 2nd degree burns in 87 (79.2%) cases (Table 2). The association of different degrees in the same patient was found in 05 children (4.1%).

Table 2. Distribution of patients according to degree of burn.

Depth	N	%
2nd degree		
Superficial	87	79.1
Profound	23	11.1
3rd degree	**12**	**9.8**
Total	**122**	**100**

3.5. Complications

On admission, out of 122 children, 74 (60.7%) children with burns presented complications on admission (Table 3).

Table 3. Distribution of children with burns according to complications on admission.

Complications	N	%
Dehydration	36	48.6
Infection	10	13.4
Anemia	21	28.4
Respiratory distress	3	4

3.6. Paraclinical Aspects

The median hemoglobin was 11.1 mg/l (9.5 - 13.1), the median hematocrit was 33

(29 - 37) and the median white blood cell count was 11.3 (8.8 - 17.0).

The mean:

- Natremia was 133 ± 7 mEq/L with extremes of 118 mEq/L and 156 mEq/L;
- kaliemia was 4.32 ± 0.83 mEq/L with extremes of 2.8 mEq/L and 7.1 mEq/L;
- Chloremia was 104.8 ± 3.9 mEq/L, with extremes of 93 mEq/L and 115 mEq/L.

3.7. Therapeutic Aspects

- **Pre-hospital care**

The first procedures performed by the family were mainly undressing 72 (59%) of the children, followed by cooling with tap water in 13 (10.7%). Fifteen (30.3%) children had not undergone any procedure.

- **hospital management**

Of the 122 cases, 111 (91%) children were admitted to the burns unit. Eleven (9%) children had been admitted to the pediatric intensive care unit.

Oxygen therapy on arrival in the PICU was initiated in six children (4.9%). All hospitalized children received fluid and electrolyte replenishment within 24 hours. The Carjaval rule was recommended for all patients.

- **Analgesics**

In our series, analgesic treatment involved more use of stage I n = 117 (95.9%), tramadol n = 6 (4.9%) and morphine n = 1 (0.8%).

- **Plaster cast immobilization** and postural orthotics were the orthopedic devices most frequently used in 31 (25.4%) and 18 (15%) children respectively.
- **Local care**

Phlyctenes were removed in 113 (92.6%) children, the remaining nine (7.4%) were patients who had undergone treatment prior to arrival.

Dressings were made with silver sulphadiazine in 120 (98.4%) children, vaseline in 118 (96.7%) children and greasy tulle in 13 (10.4%) children.

Fifteen children (12.3 per cent) with recent deep burns were referred for excision and skin grafting, but none of them had undergone surgery during the period covered by our study, most often due to a lack of financial resources.

- **Psychotherapy** was carried out in 4 patients (3.5%).

3.8. Outcome

Hospitalization: The average length of hospitalization was 11.5 days, with extremes of 11 hours and 62 days. We observed 10 deaths (8.2%). On average, it occurred 7 days after the burn, with extremes of 7 hours and 67 days, and 11 days after hospitalization, with extremes of 6 hours and 62 days. Dehydration was the main cause, with five deaths, severe anemia 3 and sepsis 2.

4. Discussion

Our study was a single-center study involving both retrospective and prospective data collection. This explains its limitations, in particular the small sample size, the high number of cases where the mechanism of the burn was unclear, and the

fact that infections were not sufficiently documented.

4.1. Social and Demographic Aspects

We note a predominance of burns in children compared with adults. Zahid *et al.* [7] and Zhu *et al.* [8], who carried out studies in Burn Treatment Centers (BTCs), reported 45.7% and 43.6% respectively of children with burns. According to Peck [9], children are more at risk from burns because of their physiological and psychological characteristics. In physiological terms, at the same temperature, children burn about four times faster than adults: water at 60˚C burns a child's skin in one second, compared with 5 seconds for an adult. This greater fragility of children is because their skin is thinner than that of adults.

The annual incidence of burns in children in our series was 61 cases per year; these results are close to those reported by Guero *et al.* [10], with 60 and 58.5 cases per year respectively.

Other authors [10]-[12] have also reported the male predominance found in our study. Children are generally inattentive, impulsive and hyperactive, and this behavior is more pronounced in boys than in girls, making them more prone to accidents [13]. On the other hand, Ali *et al.* [14] reported a predominance of females (53.3%), which is thought to be related to girls' regular participation in cooking tasks as they get older.

The median age is 2 years, which is identical to that of Bonnet [15] which was 2.2 years. Amengle *et al.* [16] found a mean age of 3.99 years and Ali *et al.* [14] 3.3 years. The 0 - 5 age group is the most represented (73%) in our series. Other authors, notably Amengle *et al.* [16] with 48.5% of cases, have reported this predominance. Bonnet [15] in France found a predominance of children aged between 16 months and 6 years in 75% of cases. These data can be explained by the fact that children under 5 years of age are in the throes of psychomotor development, discovering their environment, gaining autonomy, exploring and experiencing new things. These facts make them more exposed to danger. However, the WHO [2] reports that children under 5 years old living in Africa are twice as likely to be burn victims as those living in the rest of the world.

Over half of our patients (58.2%) came from a low socio-economic background. Indeed, Zahid *et al.* [7] and Messaadi *et al.* [17] found that 75% and 62.2% respectively of children came from disadvantaged backgrounds. According to the WHO [2], people living in low- and middle-income countries are exposed to a higher risk of burns than people living in high-income countries; in all countries, the risk of burns is correlated with socio-economic status.

4.2. Circumstances of Occurrence

- **Period**

We note that burns often occur during holiday periods. This observation was also made by Zahid *et al.* [7], who highlighted the fact that burns mainly occur during the summer months, school holidays and public holidays. This trend could

be explained by the absence of school activities exposing children to domestic accidents.

We note that this period coincides with the long dry season during which temperatures are low and people tend to boil their bath water, which increases the risk of scalding. Lin *et al.* [18], and Van *et al.* [19] found a high frequency of burns in 71.3% of children during the winter period.

- **Etiology**

In our study, burns in children are often accidental in 94.2%. Indeed, Tchaou *et al.* [12] reported 93.9% of cases of accidental burns and [7] reported 95%.

Intentional burns, in our series, are of criminal origin or linked to a suicide attempt. Etoundi *et al.* [20] found 3.5% of burns in children due to attempted suicide, while Zahid *et al.* [7] found 1.6% of cases of criminal burns.

We suspected maltreatment in a 3-year-old child who presented with a burn in circumstances unknown to those around him. The possibility of a maltreatment burn should be considered when two of Stone's criteria [21] are present: perineal location or symmetrical isolated lesions, unexplained associated lesions, unusual delay in consultation, child brought to emergency by a third party other than the parents, incoherent scenario, abnormal behavior of the child or the parents. According to the literature [22], between 6% and 20% of child abuse involves burns, and around 10% of child burns are caused by abuse.

- **Type**

Thermal burns are by far the most frequent and often occur because of scalding by spraying a hot liquid [7] [16] [20] [23].

Flame burns accounted for 11.7% of our cases. Zahid *et al.* [7], Plancq *et al.* [23] and Ouedraogo *et al.* [24] found 8.3%, 17% and 23.51% respectively. These burns are explained by the accessibility and handling of these products in the context of recreational activities or criminal acts.

Burns caused by contact with a hot object were the third most common mechanism of thermal burn in our series, accounting for 7.5% of cases. Plancq *et al.* [23] reported 9% of cases of burns due to contact with a hot solid.

Electrical burns ranked second with 1.6% of cases. This observation had already been made by other authors [7] [23] [24].

- **Location**

Burns most often occur in the family home [10]. Children are exposed to domestic accidents [25]. Burns occur most often in the kitchen [26]-[29], which is the most dangerous room in the house [14] [23].

The backyard was the second most dangerous place in our series, accounting for 27.1% of cases. Ali *et al.* [14] found that 32% of burns occurred in the backyard, whereas Plancq *et al.* [23] reported that the bathroom was the second most common location for burns in the home. This discrepancy could be explained by differences in lifestyle between Africa and industrialized countries.

- **Context**

In our study, burns were more individual, accounting for 97% of cases. Guero

et al. [10] reported 84.9% individual burns. Collective burns are less frequent. These are often flame burns of criminal origin involving members of the same family.

4.3. Diagnostic Aspects

- **Medical history**

Our patients (93.4%) did not often have a significant pathological history, as in the Bonnet series [15]. On the other hand, certain pathologies whose attacks are unpredictable, in particular epilepsy, asthma and psychiatric disorders, were found [30], but without any link with the burn.

- **Consultation time**

In our study, the majority of burns were recent (73%), with 44.3% of children consulting after the 6th hour. Ouedraogo *et al.* [24] and Boumas *et al.* [11] found 38.3% and 37.2% respectively. A delay in admission of more than 6 hours is a poor prognostic factor because of the high risk of infection.

- **Characteristics of burns**

- Topography

In our series, burns most often involve the limbs, with the trunk and face being the most frequent locations. This is consistent with the literature [11] [30]. Children frequently use their limbs to explore and discover their environment, which could justify these topographies.

- Burnt

Skin surface area The average SCB found in our study was 22%. Drago [31] reported an average of 25%. Patients with a SCB > 10% represented 86.1% of cases in our series. Mougui *et al.* [32] found 73% of burns > 10%. On the other hand, Boumas *et al.* [11] reported a percentage of 34.3%.

- **Depth**

The predominance of 2nd degree burns found in our study is consistent with the literature. [14] [24]. The majority of burns in our series were superficial 2nd degree burns in 79.1% of cases. Ouedraogo *et al.* [24] reported 75.1% of superficial 2nd degree burns. This is similar to our results. Deep 2nd degree burns come second with 11.1% of cases and 18.3% of cases for Ouedraogo *et al.* [24].

- **Complications**

- Infections are one of the main complications of severe burns, accounting for 13.4 per cent of cases, and are also one of the leading causes of death.
- Anemia: we found 6.3% of cases of severe anemia; on the other hand, Amengle *et al.* [16] found 13.2% of severe anemia. In burns, anemia has a double origin: surgical bleeding or bleeding during dressings and blood spoliation in intensive care. Hemolysis is a rarer cause and the drop in he-moglobin level, frequently encountered in the initial resuscitation phase, es-sentially reflects a false anemia linked to hemodilution, a consequence of hydroelectrolytic resuscitation [33].
- Undernutrition

In our series, we found 3.3% cases of undernutrition. Burns cause hypermetab-

olism, which can last up to 9 months after the accident. The early introduction of oral or enteral nutrition (within the first 6 to 12 hours) is associated with clinical and biological benefits, such as attenuation of the neuro-hormonal stress response and the hypermetabolic response, an increase in immunoglobulin production, and a reduction in the incidence of stress ulcers [34].

4.4. The Therapeutic Aspects

Ninety-one percent of burned children are hospitalized in the burn unit of the trauma department and 9% are transferred to the pediatric intensive care unit. These data are similar to those of Hamdaoui [35] with 10.8% transferred to pediatric intensive care. All the patients in our series benefited from hydroelectrolytic resuscitation in accordance with Carjaval's law [36]. The literature recommends perfusing a burned child as soon as 10% of the skin surface is affected [37]. The aim of these fluids is to compensate for intravascular fluid leakage. Although this is at the forefront of the clinical picture during the first forty-eight hours, it is at its maximum during the first hour.

- **Analgesics**

Paracetamol infusion is used systematically in all children admitted to the department. Tchaou *et al.* [12] also found injectable paracetamol to be the analgesic used in the majority of cases. On the other hand, Guero *et al.* [10] and Mougi *et al.* [32] reported the immediate use of morphine derivatives.

- **Antibiotic therapy**

It was prescribed in 53.7% of cases in our series. Tchaou *et al.* [12] had reported systematic administration of antibiotic therapy, partly because of the conditions of collection, and partly because burned children were hospitalized in the same ward as other patients, with the risk of nosocomial infection. The literature recommends that antibiotic prophylaxis should only be instituted in the perioperative period [37]. Outside this period, antibiotic therapy is not recommended for prophylaxis or localized infection. The use of antibiotics is reserved for generalized infections, documented by bacteriological analysis of samples and adapted to the antibiogram [23]. Betalactam antibiotics, in particular ceftriaxone, the combination of amoxicillin and clavulanic acid or metronidazole, are the main molecules used by most authors [12] [32] [35] [38].

- **Local care**

Local care in our study included washing and rinsing the lesions with water, antiseptics and saline solution; then trimming and covering with a greasy dressing based on silver sulphadiazine, Vaseline or greasy tulle.

Tchaou *et al.* [12] reported that local treatment consisted of saline cleansing, excision of phlyctenes and occlusive dressing with a trolamine or aqueous eosin ointment. Ali *et al.* [14] reported that trimming and occlusive dressings were the only local treatment in 34.6% of cases in their study.

- **Surgery** was indicated in 35.1% of cases, including 12.3% of children with recent burns and 23.8% of those with sequelae. Surgical treatment was per-

formed in 6.8% of cases in children with sequelae. This involved skin graft release (for elbow and finger flaps) and skin grafting after obtaining a bud on retraction. No surgery was performed on recent burns. For Chafiki *et al.* [39], the most common surgical procedures were retraction release followed by immediate skin graft coverage in 42% of cases and skin plasty in 40% of cases.

Physical medicine care consisted of cast immobilization in 25.4% of cases and postural orthoses in 15%. However, massage therapy and pressotherapy were recommended to all patients. Massage therapy is a re-education technique that restores elasticity to the damaged body envelope and reduces muscular tension, thereby promoting skin mobility. Massage also improves the abnormal consistency of scar tissue and the aesthetic appearance of scars [40]. Pressotherapy follows early compression in the acute phase to prevent hypertrophy and retraction. This compression encourages collagen fibers to orientate uniformly, thereby reducing scar thickness [40].

- **Psychotherapy** was used in 3.5% of cases in our series. Burns cause considerable psychological suffering linked to the destruction of the skin. Psychological support must be organized for the child, parents and siblings. In this context of long, repeated, painful treatment, separation from the family environment and prolonged hospitalization, various psychological disorders may be observed [23].

After healing, 91 children (74.6%) were reviewed.

In our series, the most common sequelae were dyschromia and retractile scars in 18.7% of cases. Mohsine *et al.* [41] reported a predominance of retractile flanges in 54% of cases, keloids and hypertrophies in 22.6% of cases, and scarring alopecia in 73% of cases.

- **lethality**

In our study, the case fatality rate was 8.2%, which is similar to that of authors in Africa such as Ali *et al.* [14] and Boumas *et al.* [11], who found 9.3% and 11.4% of cases respectively. In France, on the other hand, Pallier *et al.* [42] found a case-fatality rate of 2.5%. Children under 5 years of age (70%) with a serious burn are the most affected. In fact, there is a significant correlation between burnt body surface area and lethality [16] [24]. The main causes of death in our series were dehydration in 50% of cases, anemia in 30% and sepsis in 20%. The poor prognostic factors found in our study were: age between 0 - 5 years, SCB > 20%, 2nd and 3rd degree burns and the occurrence of complications, which are consistent with the data of Ali *et al.* [14], Tchaou *et al.* [12] and Amengle *et al.* [16]. According to the WHO, burn mortality is a real problem throughout the world, especially in developing countries where the management of burn victims remains a real challenge [2].

5. Conclusion

Despite its limitations, our study found that burns in children are a common emergency in our practice. It most often affect young boys of pre-school age, from

low socio-economic backgrounds. These children are frequently exposed to heat sources by accidental scalding. The lesions caused are often shallow but serious in their extent. Treating a child with burns requires a proper assessment of the severity of the injuries, and there are rules to follow when preparing the patient for treatment. The major complications are dehydration, anemia, infection, sequelae and death. The morbidity and mortality associated with burns in children remain a major health problem. Preventive measures are the most effective way of reducing the incidence and complications of this condition.

Conflicts of Interest

The authors declare no conflict of interest.

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