

# EPIDEMIOLOGY OF PEDIATRIC BURN INJURIES TREATED IN THE DEPARTMENT OF PEDIATRIC SURGERY TARGU MURES BETWEEN 1ST JANUARY 2007 AND 31ST DECEMBER 2011. A RETROSPECTIVE STUDY

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## Abstract

The burn is depicted as a traumatic lesion provoked by several possible agents (thermal, chemical, mechanical, or electrical) involving different skin layers to a certain degree. Children are considered a risk group because most of them cannot protect themselves. We included in our study 411 patients presented in the Department of Pediatric Surgery of the Emergency County Hospital Mures between 1st of January 2007 and 31st of December 2011, diagnosed with burn injury. A total of 112 (27,25%) needed hospitalization. Analysing the distribution of the pathology by sex, the data emphasize a proportion of 55,23% in the male population. A proportion of 71,42% provided from rural areas. . The most common lesion mechanism was scald, with 52,34% of total cases, followed by flame injuries with 27,09%. From topographic point of view, most of the burns were located to the upper limbs, 205 (49,87%). The average of hospitalization days was 13,11. We requested help from other specialities for 8 patients.

Most of these wounds can be ambulatory treated. Patients under 6 years are dominated by scalding burns that drops with age, while the flame burns have a reverse trend. Most burns were found in the upper limbs, which proves that the lesional mechanism was determined by the child's desire to explore, rather than because of the accident. We believe it is important to establish serious prevention initiatives for these injuries. Even though they play an essential role in children trauma, burns have low mortality and morbidity rates.

**Key words:** burns, epidemiology, children

## Background

The burn is depicted as a traumatic lesion provoked by several possible agents (thermal, chemical, mechanical, or electrical) involving different skin layers to a certain degree.

Children at greatest risk are those who cannot protect themselves. Children with neurologic disorders, disabilities, and developmental delays also present a higher risk from inability to protect themselves and have a higher incidence of preventable injuries, have extended hospitalizations, and

bear significantly higher mortality risks.(1) Children may sustain burn injury through a variety of different energy sources which include thermal, electrical or chemical. Burns account for the greatest length of stay of all pediatric hospital admissions for injuries (2) and costs are substantial, with many hours of wound care and follow-up visits necessary, sometimes lasting months to years (3).

Assessment of the clinical situation is based on (1) evaluation of the total body surface of the burns, and (2) estimation of burn depth. Burn severity is dictated by: (a)percent total body surface area (TBSA) involvement, (b) depth of burn injury (table 1), (c) age, (d) smoke inhalation injury, (e) associated injuries, (f) delay in resuscitation. From TBSA point of view, in children we use an estimating system called Lung-Bowder diagram for extent of burns, adapted from The Treatment of Burns, edition 2, Artz CP and Moncrief JA, Philadelphia, WB Saunders Company, 1969. The problem in treated different than in adults because children have proportionally larger heads (up to 20%) and smaller legs (13%) than adults.

Jackson describes three concentric zones in the burn wound, that supplies a practical basis in intendance of burn injuries. The central area of the burn wound, that having most close contact with the lesional mechanism, is called the zone of coagulation. This area is characterized by coagulation necrosis of the cells. Concentrically, from this zone, extends an area of dermal ischemia called the zone of stasis. This condition is not lethal for the cells. Peripheral, it is described a zone of minimal injury, appointed the zone of hyperemia, which will recover after a period of 7 to 10 days. (4)

## Material and methods

We included in our study all the patients presented in the Department of Pediatric Surgery of the Emergency County Hospital Mures between 1st of January 2007 and 31st of December 2011, diagnosed with burn injury, hospitalized or ambulatory treated.

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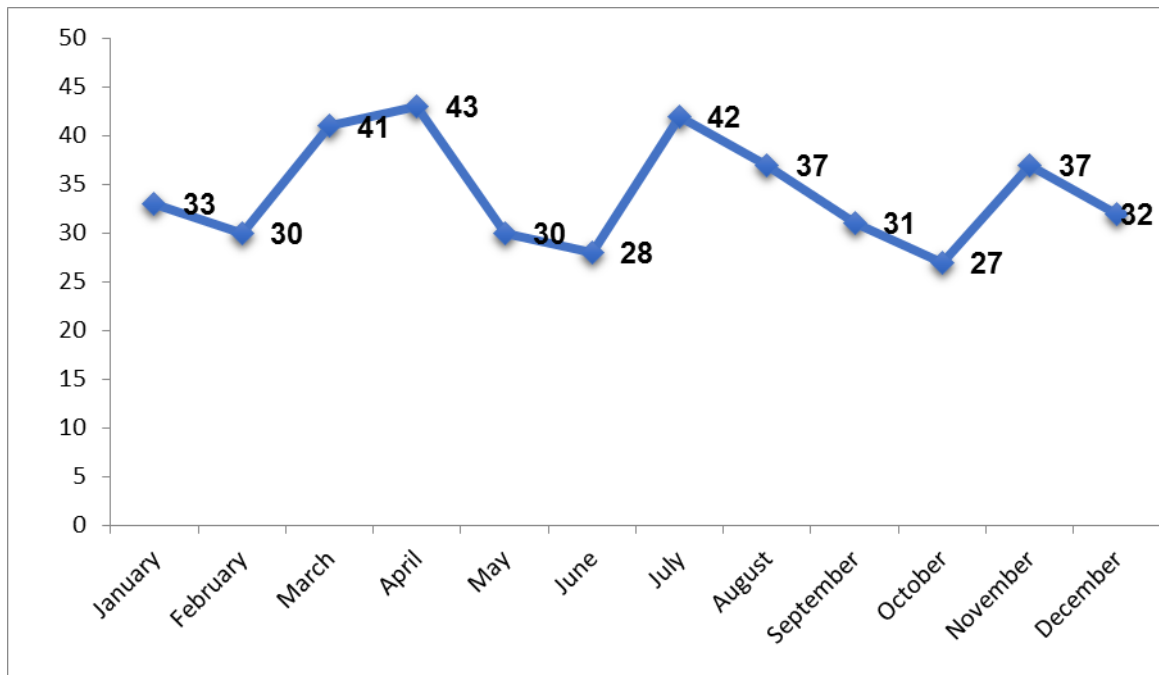


Fig. 1. Distribution of burn injuries during the year.

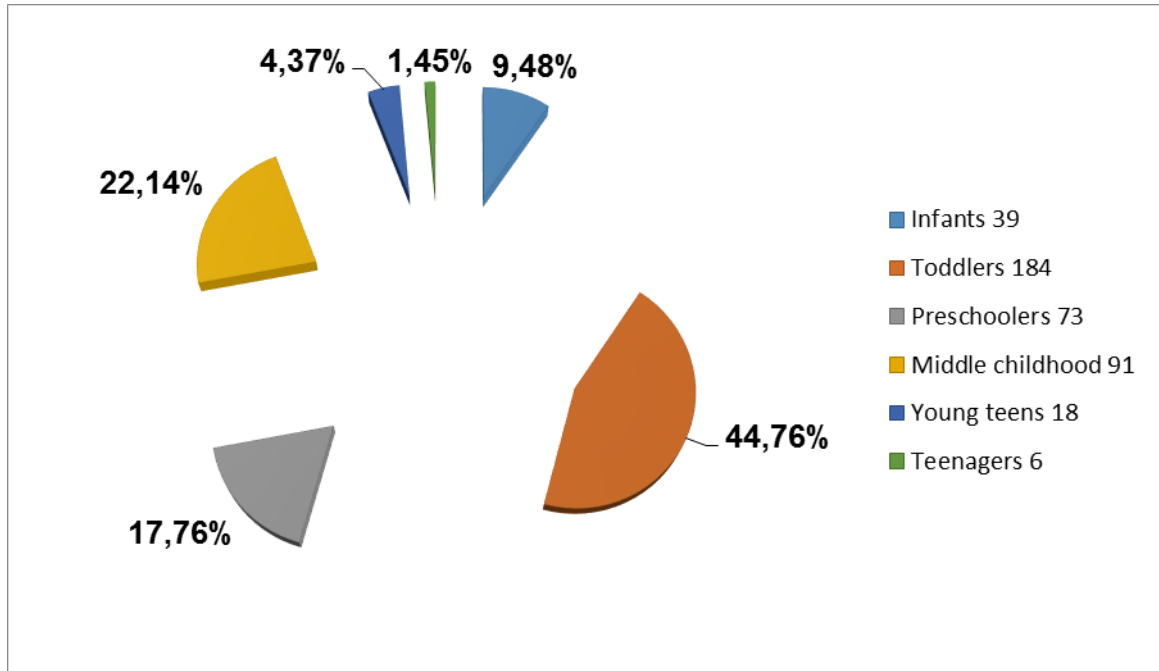


Fig. 2. Distribution of cases on groups of age.

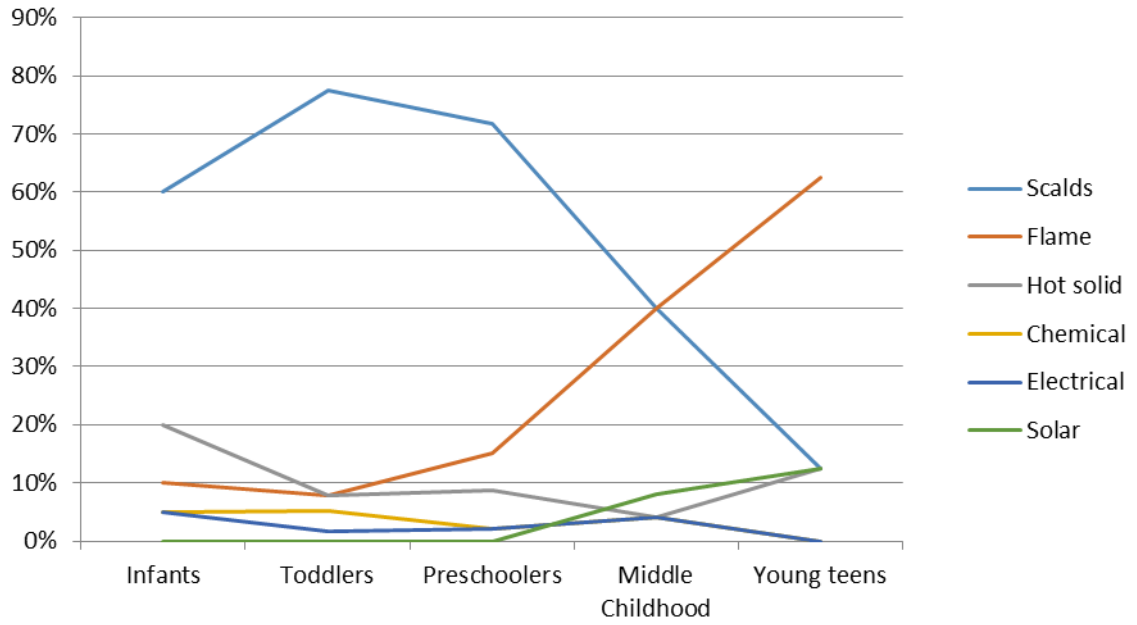


Fig. 3. Epidemiology of burns.

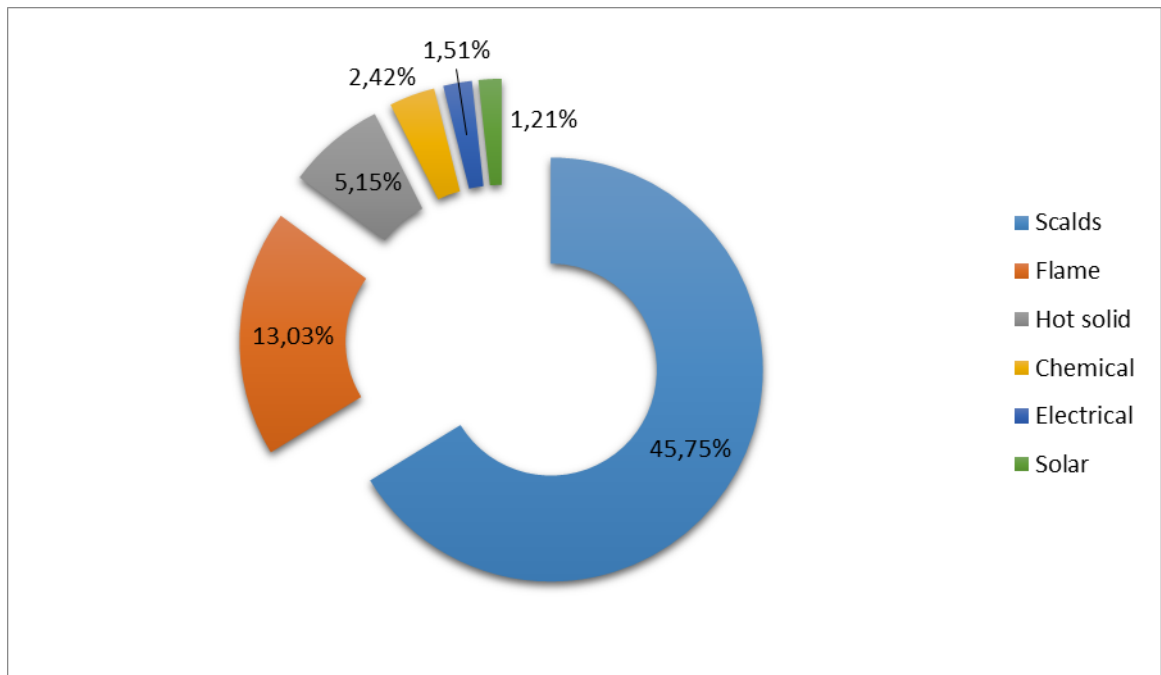


Fig. 4. Etiology of burns.

We used American Burn Association criteria for admission in the hospital, as follows: (1) partial-thickness burns of greater than 10% of the total body surface area, (2) burns that involve the face, hands, feet, genitalia, perineum, or major joints, (3) third-degree burns in any age group, (4) electrical burns, including lightning injury, chemical burns, (5) burn injury in patients with preexisting medical disorders that could complicate management, (7) any patients with burns and concomitant trauma (such as fractures) in which the burn injury poses the greatest risk of morbidity or mortality, (7) burned children in hospitals without qualified personnel or equipment, (8) burn injury in patients who will require special social, emotional, or rehabilitative intervention.

As the child's respiratory and cardiovascular status was stabilized, attention was directed toward the management of the burn wounds. Immediately following injury, clothing was removed, and a total survey of the body was performed in a clean, warm environment. In children with large burns, assessing only a portion of the body at a time was necessary to maintain the child's temperature. Less obvious areas of injury, such as the scalp and oropharynx, were examined for evidence of thermal injury. Regular assessment of peripheral pulses was performed on involved extremities. Surgical escharotomies was required during the resuscitation phase in some cases to restore effective circulation to extremities and digits. After the escharotomy has been performed, the neurologic status of the affected limb was assessed frequently because peak edema formation does not occur until 24 hours after the burn. Wounds were cleaned with antibacterial substances and sterile water or NaCl. Loose tissue was mechanically debrided, and the prescribed topical agent was applied. The head and extremities were elevated for comfort and to minimize fluid accumulation.

## Results

We registered a 411 cases of burn injuries, of which a total of 112 (27,25%) needed hospitalization, the rest being ambulatory treated. The distribution of cases during the year was uniform, with a peak in April, when 43 cases were registered (figure 1). Most cases were recorded in 2010 (92 representing 22,38%), the least being in 2008 (67 representing 16,30%).

We divided patients by age, related to CDC (Centers of Disease Control and Prevention) in 6 groups: I-infants(0-1 years of age), II-toddlers(>=1-<3 years of age), III-preschoolers(>=3-<6 years of age), IV-middle childhood(>=6-<12 years of age), V-young teens(>=12-<15 years of age), V-teenagers(>=15-<18 years of age). Most cases were found in the toddlers group (114 means 27,73%), highlighted in figure 2.

Analysing the distribution of the pathology by sex, the data emphasize a proportion of 55,23% in the male population. 71,42% of our study patients are from rural areas. Table 1 lists the burning agents by age group. It is easily remarkable that scald injuries occurs in infants and toddlers group, but they progressively decrease with age (figure 3), while flame injuries had a reverse shape. There were to few cases in teenagers group to be turned into

percentage. The most common lesion mechanism was scald, with 52,34% of total cases, followed by flame injuries with 27,09%.

From topographic point of view, most of the burns were located to the upper limbs, 205 (49,87%), the rarest being registered into the external genitalia region. The other body segments were affected like this: head and neck 95 (23,11%), trunk 118 (28,71%) and inferior limbs 152 (36,98%).

A number of 376 patients (91,48%) presented 2nd degree burns, 115 (27,98%) 3rd degree, 107 (26,03%) 1st degree and only 9 (2,19%) has 4th degree burns.

Using Lund-Bowder diagram for extent of burns, we had 322 (78,35%) burns <10% body surface (BS), 53 (12,90%) patients with burns <10-20% BS, 23 (5,60%) <20-30% BS and 13 (3,16%) patients with burns involving up to 30% BS. We hospitalized 112 (27,25%) patients, the rest being ambulatory treated, until the wound presented signs of epithelization. Of all hospitalized patients, 4 patients were discharged on request on their own responsibility, being treated as outpatient. A number of 19 patients refused the admission, against to physician's recommendations. The average of hospitalization days was 13,11 days, with a peak of 99 days, and a minimum of 1 day. In this estimation, we didn't consider the patients discharged on request. 4 of our hospitalized patients needed intensive care support, so they were transferred in the pediatric IC unit, the average of days spent here being 8. One death has been registered after 12 days of intensive care, in a 3 years old girl with grade 2,3 and 4 burns on 35% BS, after flame injury.

All of the patients who presented in our service with burn injuries received antitetanic vaccine, wound cleaning and dressing. The hospitalized patients were treated as follows: 56 (50%) needed excisional debridement, 44 (39,29%) received nonexcisional debridement, 11 patients required skin grafts, 5 (4,46%) on less than 3% BS and 7 (6,25%) on more than 3% BS. In 58 (51,79%) cases we used general anesthesia for doing the surgical maneuvers, the rest receiving proper pain management. One patient needed mechanical ventilation for vital functions support, and another one requested surgery for correcting the scar contracture; we used local skin flaps technique (z-plasty).

We requested help from other specialities for 8 patients(1,95%), like this: 2 dermatological consults, 2 infectious diseases consults, 2 ophthalmological consults, and plastic surgeons opinion for one patient.

## Discussions

Most researchers who have studied in depth the epidemiological problems of burns in children have reached the same conclusion: the most important thing in the management of burns in children is prevention. Cohen and Swift came to help in this problem by developing a framework of counter measurements for a large scale application, in Spectrum of Prevention. A first step in this initiatives has to be to recognize that adequate supervision of children remains a major prevention tool for avoiding accidents of all type. Studies demonstrated that lack of

supervision is the the first reason attributed to burns accidents.(5)

In terms of gender distribution we obtained comparable results to Orozco-Valerio's study (6), where the injuries in male population was three times higher than in female one, and also more important. There are several studies that indicate higher incidence of burns in boys. (7),(8),(9),(10),(11)

We divided our patients by age group, and we found most cases in toddlers group ( $\geq 1$ - $< 3$  years). Consistent to our data are El-Badawy's results (7), who found 57% burns in children younger than 4 years old, with a maximum under 2 years old, the same with Híjar-Medina's data (8), and Orozco-Valerio who found 48,3% burns under 2 years of age. (6) Lari (9) and Gari (11) have data in the same frame, in studies conducted in Iran, respectively Nigeria.

The main mechanism of injuries is represented by scalds, followed by flame injuries. The same classification was obtained in more other studies, with a very similar percentage. Orozco-Valerio reported 55,9% scalds and 28,0% flame injuries (6), Rawlins counted 51% scalds (12), Forjuoh obtained a percent of 58 scalds (13), and Lari's study returned 46,2% (9). As in our results, Gupta specify greater preponderance of burns in children less than 5 years, in older children flame injuries being prevalent (10). Also, many other studies certify the predominance of scald burns. (11),(14),(15). Scald injuries can be caused by any type of hot liquid including tap water, tea and coffee and more viscous liquids such as soups, grease and tar (11).

Mashreky described in two successive studies developed in Bangladesh a significant difference in terms of

the number of burns in rural and urban, with a prevalence of 4 times higher in rural areas (16,17). In our results we find a difference more than 2 times higher for the patients from rural areas.

Our patients was discharged after the rebalance of vital functions, fluid resuscitation, pain management, setting a custom nutritional formulas, burn wound management, in a condition that allows us to treat him ambulatory. The average of hospitalization days was 13,11 days, not far from Forjuoh's work, who reported an average of 13,4 days. (13)

### Conclusions

Burns remain an important cause of injury in children besides efforts to improve the treatment of these patients. Most burns occur in children under 3 years, which reinforces the idea that the mechanism of these lesions recipes always related cognitive and motor functions in connection with child's ability to explore the environment, lack in assessing possible hazards, and not finally, the negligence of parents. We believe it is important to establish serious prevention initiatives for these injuries.

Most of these wounds can be ambulatory treated. Patients under 6 years are dominated by scalding burns that drops with age, while the flame burns have a reverse trend. Most burns were found in the upper limbs, which proves that the lesional mechanism was determined by the child's desire to explore, rather than because of the accident. Also, most burns were 2nd and 3rd degree, because the children's self-defense reflex mechanisms are not well developed.

Even though they play an essential role in children trauma, burns have low mortality and morbidity rates.

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