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Burn trauma in infants



Yasemin Demir Yiğit¹ , Ebral Yiğit^{2*} and İlhan Taş²

Abstract

Background A wealth of data exists concerning pediatric burn epidemiology in general, but more is explicitly needed in infants under 1 year of age, a particular group in which mobility begins to develop.

Methods In this study, 206 patients followed up for burns in Diyarbakır Gazi Yaşargil Training and Research Hospital Burn Center between January 2016 and September 2021 were included in the study.

Results Of the patients, 120 (58.3%) were male, and 86 (41.7%) were female. The mean age was 10.0 ± 2.0 months. The total number of cases ranged from 3 to 12 months, with the incidence of burns peaking at 12 months.

When we look at the etiology of burns, scalding burns were the most common, with 184 (89.3%) cases. Most of the burns occurred in the kitchen because their mothers and children spent a lot of time there.

It was positive in 23.8% of the wound culture results obtained with a punch biopsy. *Staphylococcus aureus* was the most abundant microorganism in wound culture results, with 5.8%. The mean hospital stay of the patients was 4.99 ± 3.67 days. Our mortality rate was 1.94% (n:4).

Conclusion In conclusion, As preventive measures, it is necessary to increase protective measures at home and to raise awareness of families about burn etiologies.

Keywords Infant burns, 0–1 year age, Scalding burns, Epidemiology

Background

Burns are a common cause of mortality and morbidity in children, especially in developing countries [1]. Children aged three years and younger are among the most risk groups for mortality in burn trauma, and they are more exposed to death from burns than any other age group [2]. There is limited data on burns in children younger than one year that require hospitalization worldwide [3]. Due to the relative limitation of movement in this age group, the causes of controllable burns are expected to be preventable in these children. However, despite the

preventable causes of burns, burn injuries continue and cause mortality and long-term morbidity.

Although the treatment of pediatric burn patients is similar to that of adults, there are essential differences in the physiology, acute pain management, and psychology of the pediatric patient [4, 5]. Children have nearly three times adults' body surface area (BSA) to body mass ratio. Fluid losses are proportionately higher in children than in adults. Consequently, children have more significant fluid resuscitation requirements and evaporative water loss than adults. The large BSA-to-body mass ratio of the child also predisposes the child to hypothermia, which must be aggressively avoided. Children younger than two years have thinner layers of skin and insulating subcutaneous tissue than older children and adults. As a result, they lose more heat and water than adults, losing these more rapidly than adults. In young children, temperature regulation is partially based on non-shivering thermogenesis, increasing metabolic rate, oxygen consumption, and lactate production. In addition, because

*Correspondence:

Ebral Yiğit
ebral.yigit@gmail.com

¹ Gazi Yasargil Training and Research Hospital Department of Pediatrics, Diyarbakır 21090, Turkey

² Gazi Yasargil Training and Research Hospital Department of General Surgery, Diyarbakır 21090, Turkey

of disproportionately thin skin, a burn that may initially appear to be of partial thickness in a child may instead be full thickness in depth. Thus, the child's thin skin may make initial burn depth assessment difficult. For these reasons, children with major burn trauma should be best treated in a pediatric burn center [6].

In infants, voluntary grasping begins at four months, and head and trunk control is completed in about nine months. Infants crawl at 9–11 months and start walking unaided at one year of age [7]. Burn epidemiology is a valuable tool for targeting interventions to reduce the incidence of such injuries and identifying high-risk populations [8, 9]. For this purpose, its epidemiology needs to be better understood to prevent burns in the infant population.

Methods

This is a retrospective study conducted on the burn of infants aged 12 months or less who were admitted to the Diyarbakır Gazi Yaşargil Training and Research Hospital Burn Center between January 2016 and September 2021 were included. We evaluated 206 infants with burn injuries. This study is retrospective, and written informed consent was obtained from all participants and their caregivers for the dataset used and analyzed during this study. The study was conducted under the principles of the 2008 Declaration of Helsinki, and the electronic medical record system was reviewed retrospectively with the permission of the hospital's chief physician. Patients' Demographic data, injury-related data (burn status, cause of burn injury, TBSA (total body surface area), and burn degree), major complications, and treatment outcomes were reported from the electronic medical record system.

Statistical analysis

Descriptive statistics for the continuous variables were presented as Mean and Standard deviation, while count and percentages for categorical variables. Chi-square test was performed to determine the relationship between categorical variables. Statistical significance level was considered as 5% and SPSS (Chi. Ill. USA) statistical program was used for all statistical computations.

Results

Between January 2016 and October 2021, 206 patients aged one year and younger were seen in our burn center. Of the patients, 120 (58.3%) were male, and 86 (41.7%) were female. The mean age was 10.0 ± 2.0 months (Table 1).

The total cases ranged from 3 to 12 months, with the highest number of patients seen in 12th-month infants (Fig. 1).

The low age of the mothers, the high number of births, and the low financial situation increased the risk of burn injury.

Table 1 General information about patients

	Number	Percent
Boy	120	58.3
Girl	86	41.7
Burned part of body		
Head-neck	32	15.5
Right upper extremity	60	29.1
Left upper extremity	89	43.2
Chest anterior + abdomen	47	22.8
Chest posterior + back	12	5.8
Perineum	4	1.9
Right lower extremity	84	40.8
Left lower extremity	84	40.8
Burn degree	2–3. degree	
Burn percentage	8.19 ± 5.04 (min:1-max:25)	

When we look at the etiology of burns, scalding burns were the most common, with 184 (89.3%) cases. The most common causes of scalding burns were 80.6% (n:166) hot water, 4.8% (n:10) hot oily water food, and 3.9% hot milk burns. Scalding burns were nine times more common in the 0–1 age group than other burn etiologies ($p < 0.001$).

The most common cause of hot object burns was hot stove contact burns in nine (4.4%) cases. It was formed by touching the stove by the children left next to the hot stove to warm up in cold seasons. Other reasons were a hot teapot, hot teacup, hot plate, and hot hair straightener.

In our study, 54.4% (n: 112) of the burn traumas occurred in the city, and 45.6% (n: 94) occurred in the rural area. Most of the burns occurred in the kitchen because their mothers and children spent much time there.

Burn trauma started in January and peaked in March. It decreased in summer. However, the TBSA of patients reached the highest number in July and August (Fig. 2).

The wound culture results obtained with punch biopsy were positive in 23.8%. The most common microorganism in wound culture results was *Staphylococcus aureus*, with 5.8% (Table 2).

In the majority of cases, more than one region was affected. The most affected areas were the left upper extremity (43.2%). 45.6% of the burned areas were 2nd degree and 54.4% (n:112) 3rd degree. The overall mean estimated total burn surface area (TBSA) was 8.19 ± 5.04 (min:1-max:25). Most of the cases underwent escharectomy in the operating room and were treated with dressings. Skin grafting was performed on only 10.7% (n:22) of the patients.

The mean hospital stay of the patients was 4.99 ± 3.67 days. Our mortality rate due to sepsis was 1.94% (n:4).

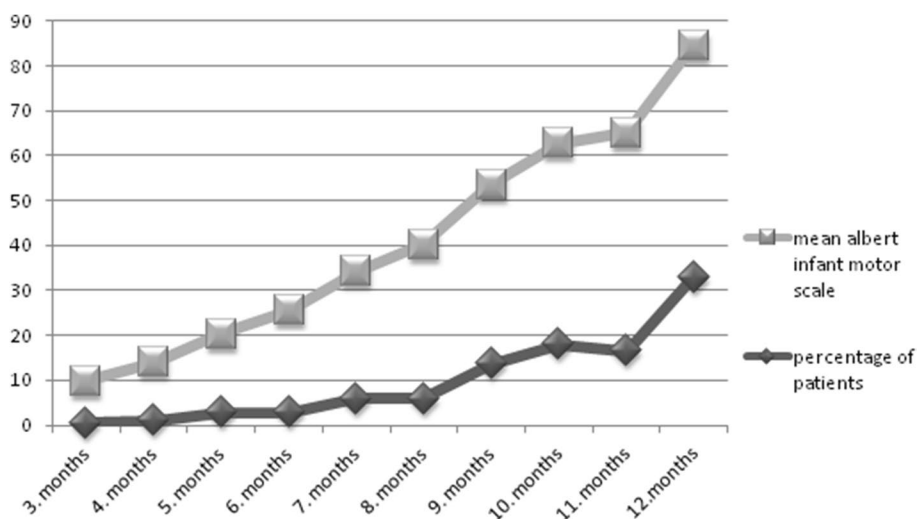


Fig. 1 0–1 age group motor scale and percentage of patients

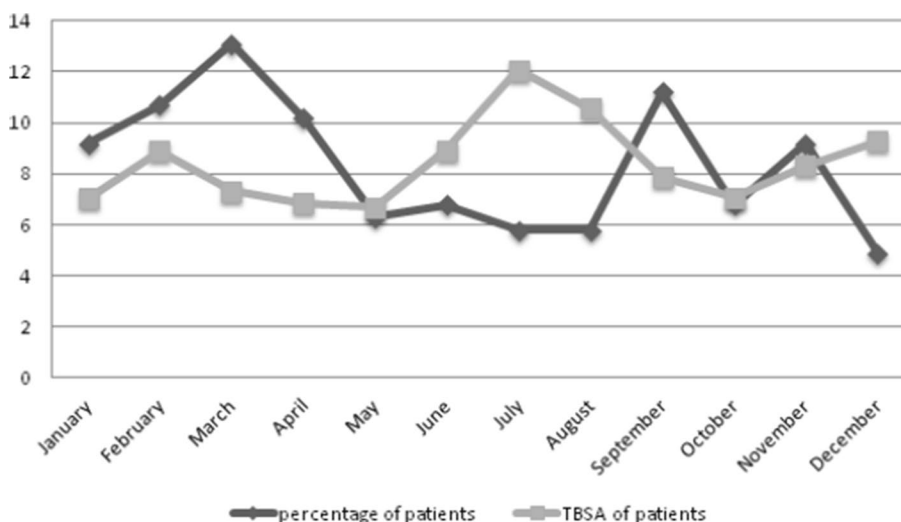


Fig. 2 Distribution of burn cases by months

Discussion

Primitive reflexes in infants gradually decrease from the first month to the third month; however, motor reflexes increase gradually starting from the first month [10]. Studies examining injuries for infants under one year old noted an increased injury rate in the second six months of life. The peak of burn applications, especially in boys in the seventh and ninth months, can be explained by the achievement of important milestones of locomotor development at this age [11, 12]. Our study is consistent with the literature, and our burn cases have increased gradually since the first three months and peaked at the 12th month in parallel with motor development.

Increased burn injury predilection in infant boys is unclear, and differences in exposure to risk did not wholly explain the sex differences [11]. In our study, it was seen that more burn trauma was in the male population, with a ratio of 1.4.

Alsaman et al. [12] stated in their study that the upper extremities were the most frequently affected body parts. In our study, The areas most affected by burns are the left upper extremity, right and left lower extremities, right upper extremity, trunk, abdomen, head, and perineum, respectively. We attribute this to the Infant’s specific group, which begins to develop mobility, starting from rolling, crawling, and finally walking around the age of one year.

Table 2 Wound culture results

pathogen	Subgroup	Number of patients	Percentage of patients
Acinetobacter	Acinetobacter braumani	1	0,5
Enterobacter	Escherichia coli	6	2.8
Enterococcus	Enterobacter faecalis	6	2.8
Klebsiella	Klebsiella pneumoniae	2	1.0
Kocuria	kocuria kristinae	1	0.5
Proteus	Proteus mirabilis	2	1.0
Pseudomonas	Pseudomonas aerogenas	3	1.5
Staphylococcus	Staphylococcus aureus	12	5.8
	Staphylococcus epidermidis	5	2.4
	Staphylococcus haemolyticus	5	2.4
	Staphylococcus hominis	3	1.3
	Staphylococcus mutis	1	0.5
	Staphylococcus lugendisis	1	0.5
	Staphylococcus Pseudintermedius	1	0.5
	Staphylococcus xylosus	1	0.5
Negative culture		157	76.2
Total		206	100

Negative culture: No growth in wound culture after punch biopsy

The most common cause of pediatric burns is scalding burns, accounting for 88.8% of all cases. It has been reported that scalding burns are a common cause of home burns. Gender, parity, socioeconomic status, and especially the mother's age influence infant burn injury risk [1, 11, 13, 14]. Our study found that the most common cause of burns was scalding at a rate of 89.3%, consistent with the literature.

In the study of H. Karimi et al., The positive culture rate from the wound site was 42.9%. In our study, however, this rate was 23.8%, and Staphylococcus spp. was isolated most frequently in culture. In this respect, our result is consistent with the H. Karimi et al. [15] study. In the study of H. Karimi et al., Before arriving at the hospital, 22 patients had received traditional therapy at home, which was not effective and caused some problems. In our study, patients received first aid treatment by directly applying to the hospital emergency department.

As a culture, the food of our region is served hot, and usually, after the sixth month of one-year-old children, food is given sitting on the floor. This creates risky areas where infants can easily reach and where accidents can happen quickly. In this study, pediatric burns most frequently occurred while cooking or eating in the kitchen. The incidence of pediatric burns increased gradually from January and peaked in March. In our region, Children are often given hot meals, which pose a risk, except for the cold foods served during the hottest months (June, July, and August).

According to the study of Dai et al., most contact burns were caused by a hot object falling on the child or by children falling on a hot object [11]. In our study, most contact burns were caused by the negligence of mothers who left their children near the stove to warm them during the cold winter months. It developed due to contact with a hot stove in children who developed a catching reflex.

Children of young mothers with low socioeconomic status are at greater risk. Similarly, Shah et al. [16] stated that having many children in a family and increasing financial deprivation increases the risk of scalding injuries. Therefore, young mothers can receive a short education and training to reduce the risk. Children of young mothers generally have a high risk of morbidity and mortality. Therefore, special attention should be paid to preventing burns, giving the mothering advice on how to care for the baby, and supporting young mothers' maternity and living conditions.

Conclusion

In conclusion, since the etiology of infant burns is different from other age groups, infant burns should be reported and investigated accurately. As preventive measures, it is necessary to increase protective measures at home and to raise awareness of families about burn etiologies. Future studies should include other important variables contributing to burns in infants, such as socioeconomics and parental education level.

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None.

Authors' contributions

EY and IT conceptualized and drafted the initial manuscript and reviewed and revised the manuscript. YDY revised and finalized the editing of the manuscript. EY and IT critically reviewed the manuscript for important intellectual content. All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

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Availability of data and materials

The dataset used and/or analyzed during this study is available from the corresponding author upon reasonable request.

Declarations**Ethics approval and consent to participate**

Retrospective /none.

Consent for publication

Informed assent and written informed consent was obtained from all participants and their care givers.

Competing interests

On behalf of all authors, the corresponding author states that there is no conflict of interest.

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References

- Özlü Ö, Başaran A (2022) Epidemiology and outcome of 1442 pediatric burn patients: A single-center experience. *Turkish J Traum Emerg Surg* 28(1):57–61
- Yasa MK, KaracaSivrikaya S (2021) Yoğun Bakımda Yanıklı Hastalarda Enfeksiyon Kontrolü ve Bakım Yönetimi. *Arşiv Kaynak Tarama Dergisi* 30(2):68–75. Retrieved from: <https://dergipark.org.tr/en/pub/akt/issue/62990/767536>
- Sesti J, Paul S (2020) Commentary: Burn, baby, burn. *J Thorac Cardiovasc Surg* 160(5):1348–1349. <https://doi.org/10.1016/j.jtcvs.2019.08.087>. (Epub 2019 Sep 20 PMID: 31610961)
- Ardahan E, Yıldırım Sarı H (2016) Pediatrik yanık vakalarında besin desteği. *Çocuk Cerrahisi Dergisi*. 30(2):106–113
- Gülhan B et al (2020) Infections in pediatric burn patients: an analysis of one hundred eighty-one patients. *Surg Infect*. 21(4):357–362
- Sharma RK, Parashar A (2010) Special considerations in paediatric burn patients. *Indian J Plast Surg* 43(Suppl):S43–50. <https://doi.org/10.4103/0970-0358.70719>. (PMID:21321657;PMCID:PMC3038395)
- Thomason ME, Hect J, Waller R, Manning JH, Stacks AM, Beeghly M et al (2018) Prenatal neural origins of infant motor development: Associations between fetal brain and infant motor development. *Dev Psychopathol* 30(3):763–772. <https://doi.org/10.1017/S095457941800072X>. (PMID:30068433;PMCID:PMC6261435)
- Ravat F, Fontaine M, Latarjet J, Voulliaume D (2018) Brûlures : épidémiologie, évaluation, offre de soins [Burn: epidemiology, evaluation, organisation of care]. *Rev Prat*. 68(10):1078–1082 (French. PMID: 30869211)
- Grant EJ (2017) Burn Injuries: Prevention, Advocacy, and Legislation. *Clin Plast Surg* 44(3):451–466. <https://doi.org/10.1016/j.cps.2017.02.005>. (PMID: 28576234)
- Kim HH, Kim JY, Jang BK, Lee JH, Kim JH, Lee DH et al (2022) Multiview child motor development dataset for AI-driven assessment of child development. *Gigascience*. 12:giad039. <https://doi.org/10.1093/gigascience/giad039>. (PMID: 37243520; PMCID: PMC10220505)
- Purcell LN, Banda W, Akinkuotu A, Phillips M, Hayes-Jordan A, Charles A (2022) Characteristics and predictors of mortality in-hospital mortality following burn injury in infants in a resource-limited setting. *Burns*. 48(3):602–607. <https://doi.org/10.1016/j.burns.2021.07.004>. (Epub 2021 Jul 13. PMID: 34284937; PMCID: PMC8755851)
- Alsaman AK et al (2015) Epidemiology of infant burn in Eastern Saudi Arabia. *Saudi Med J*. 36(3):324
- Jordan KC, Di Gennaro JL, von Saint André-von Arnim A, Stewart BT (2022) Global trends in pediatric burn injuries and care capacity from the World Health Organization Global Burn Registry. *Front Pediatr*. 10:954995. <https://doi.org/10.3389/fped.2022.954995>. (PMID: 35928690; PMCID: PMC9343701)
- Ruan J, Xi M, Xie W (2021) Analysis of 12,661 pediatric burns in Wuhan institute of burns: A retrospective study of fifteen years. *Burns* 47(8):1915–1921. <https://doi.org/10.1016/j.burns.2021.02.021>. (Epub 2021 Feb 27 PMID: 33736899)
- Karimi H et al (2012) Epidemiology of paediatric burns in Iran. *Ann Burns Fire Disasters* 25(3):115
- Shah M et al (2013) Risk factors for scald injury in children under 5 years of age: a case–control study using routinely collected data. *Burns* 39(7):1474–1478

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