Pediatric Burns- Our Experience: A Single Centre Observational Study

Preetam Anguraj[1], Sruthi. S[2], Ranjan James Premkumar[3], Ramesh. B. A.[4*]

[1]*Senior Resident, Department of Plastic, Burns and Reconstructive Surgery, Sri Ramachandra Medical College Hospital, Chennai, India*
[2]*Assistant Professor, Department of Plastic, Burns and Reconstructive Surgery, Sri Ramachandra Medical College Hospital, Chennai, India*
[3]*Assistant Professor, Department of Plastic, Burns and Reconstructive Surgery, Sri Ramachandra Medical College Hospital, Chennai, India*
[4]*Associate Professor, Department of Plastic, Burns and Reconstructive Surgery, Sri Ramachandra Medical College Hospital, Chennai, India*

***Corresponding Author:** Ramesh. B. A.
*Associate Professor, Department of Plastic, Burns and Reconstructive Surgery, Sri Ramachandra Medical College Hospital, Chennai, India. Email Id: rameshbellama@gmail.com

KEYWORDS
Parental counseling, pediatric burns, scald burns, skin grafting, total body surface area (TBSA).

ABSTRACT
Introduction: Pediatric burns accounts to a significant percentage of morbidity and mortality among all the burns. This is in fact holds stronger when it comes to low-moderate income countries owing to the patient's ability to spend and lack of infrastructure.
Materials & Methods: This is a single centre observational study including all the pediatric burns cases admitted in a tertiary care hospital in Chennai, India. A total of 35 children less than 12 years of age admitted between June 2023-May 2024 over a period of 12 months were included in the study.
Results: Scald burns (71.4%) were the most common type, followed by flame burns (22.85%), with children aged 1–5 years being the most affected (74.3%). Extensive burns (>10% TBSA) were observed in 55.3% of cases. Skin grafting was required in five children, significantly prolonging hospital stay (30.6 ± 7.63 days vs. 6.2 ± 3.07 days for those not requiring grafting). This article highlights the treatment protocol followed at our hospital, addressing challenges from parental counseling on the necessity of admission and burn care to post-hospital management.
Conclusion: This study highlights the necessity of a multidisciplinary approach involving plastic surgeons, pediatricians, intensivists, psychologists, and nutritionists for optimal pediatric burn management. Preventive strategies and timely interventions are essential in reducing burn-related morbidity and improving outcomes. Public education on burn prevention and management can facilitate better parental awareness, easing the counseling process and ensuring smoother implementation of treatment plans.

INTRODUCTION

Burns, by definition is the thermal damage caused to the skin, subcutaneous fat and the underlying tissues. The cause of the burn injury is multitude and there are more than 22 types of burns according to Stedman's medical dictionary. Children, by nature are not just miniature version of an adult human being and therefore requires additional specifications in the treatment pediatric burns. Globally, burn injuries account to over 310000 annual deaths out of which nearly 75% of patients is that of pediatric age group. The countries with middle and low incomes constitutes to 95% of the death toll which includes India also. Almost 96,000 pediatric burn deaths have been reported in this middle to low income countries.[1] In India, over 1 million people have sustained burn injuries according to WHO data of which 17.25% of admissions account to pediatric age group. [2]

The pediatric age group is more vulnerable, owing to their natural curiosity to explore the surroundings and the lack of understanding. This grows exponentially in mid to low-income countries

where the infrastructure is inadequate.[3] The challenges associated on managing a pediatric burn ranges from greater fluid loss due to three times greater body surface area to body mass ratio, thinner layers of skin making the assessment of the burn depth difficult and limited donor areas to tactfully counselling the child's parents. The aim of the study is to observe the commonest causes of burns in pediatric age group, the complications, difficulties and the challenges faced while treating the children.

MATERIALS AND METHODS

Study Design: This was a single-center, observational study conducted over a period of one year (June 2023–May 2024). The study included pediatric burn patients managed by two senior consultants.

Inclusion Criteria: Children under 12 years of age admitted with burn injuries.

Exclusion Criteria: a) Children above 12 years of age. b) Patients discharged against medical advice.

Treatment Protocol: All pediatric burn victims were admitted to a specialized burns unit and received standardized care. Initial management included prophylactic broad-spectrum antibiotics and fluid resuscitation based on the Parkland formula. Once adequate resuscitation was achieved, burn wounds were debrided under anesthesia, followed by the application of special silver-impregnated dressings and/or collagen. The need for secondary debridement was determined based on clinical symptoms, progression of the wound and laboratory parameters, with procedures performed under anesthesia as required. Deep burns that were failing to heal spontaneously were managed with split-thickness skin grafting, adhering to an early grafting protocol. Children with total body surface area (TBSA) burns >10% or those presenting with severe dehydration were admitted to the Pediatric Intensive Care Unit (PICU) for close monitoring by a team of pediatric intensivists. Intensive care continued until the child's condition stabilized and primary debridement was performed.

Statistical Analysis: Data were collected and analyzed using Microsoft excel version 2021. Categorical variables were expressed as frequencies and percentages, while continuous variables were presented as mean ± standard deviation (SD).

RESULTS

Total 35 patients were included in this study. The most affected age group was 1–5 years (74.3%), as children's natural curiosity drives them to explore their surroundings. The incidence decreased with age, with 6–10 years (17.1%) and >11 years (5.7%), as older children become more aware of potential hazards. Infants <1 year (2.9%) had the lowest incidence due to their dependence on caregivers. Burns were slightly more common in males (51.4%) than in females (48.6%) [Table 1]

Table 1: Distribution of pediatric burn cases by age and gender

Characteristics	No of patients (n=35)	Percentage
Age groups (years)		
<1	1	2.9%
1 – 5	26	74.3%
6 – 10	6	17.1%
>11	2	5.7%
Gender		
Female	17	48.6%
Male	18	51.4%

The most common type of burn was scald burns (71.4%), followed by flame burns (22.85%), while chemical and contact burns each accounted for 2.9% (Figure 1).

Figure 1: Distribution of pediatric burn cases by type of burn

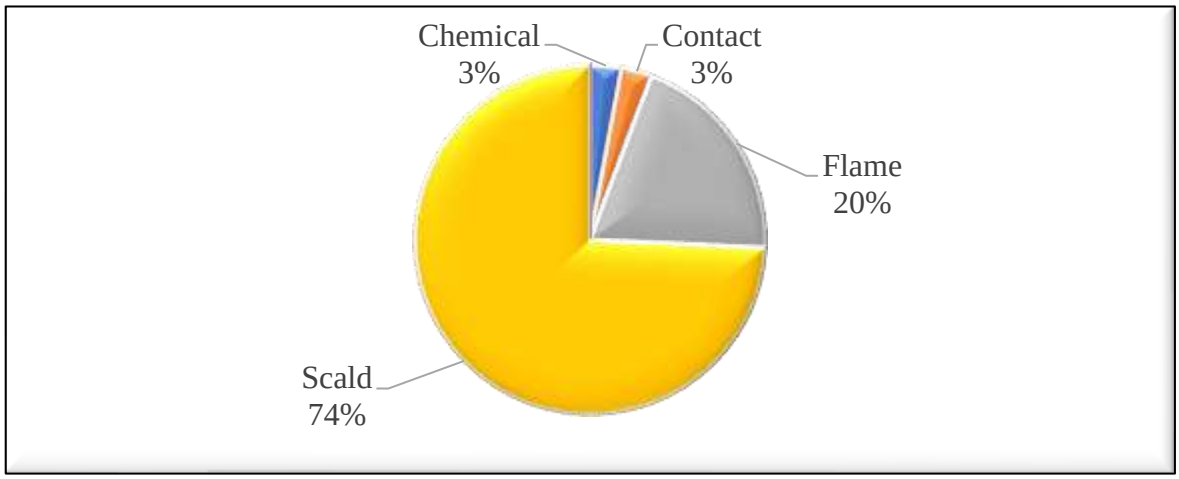
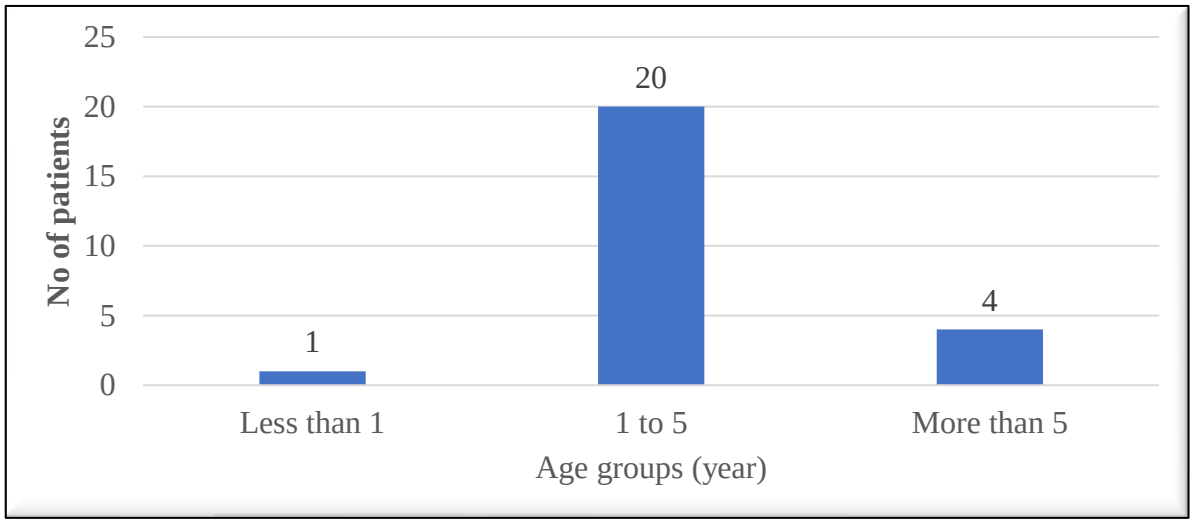


Figure 2: Distribution of scald burn according to age group



Out of 25 scald burn victims, the majority (80%, 20 patients) were 1–5 years old, followed by 16% (4 patients) over 5 years and 4% (1 patient) under 1 year. Hot water scalds (60%) were the most common cause, affecting 15 of 25 children. Nearly 50% of these injuries resulted from accidental toppling of vessels containing hot water during steam inhalation, a traditional method for relieving nasal congestion. The risk is heightened by the child's illness and lack of supervision, making electric vaporizers a safer alternative.

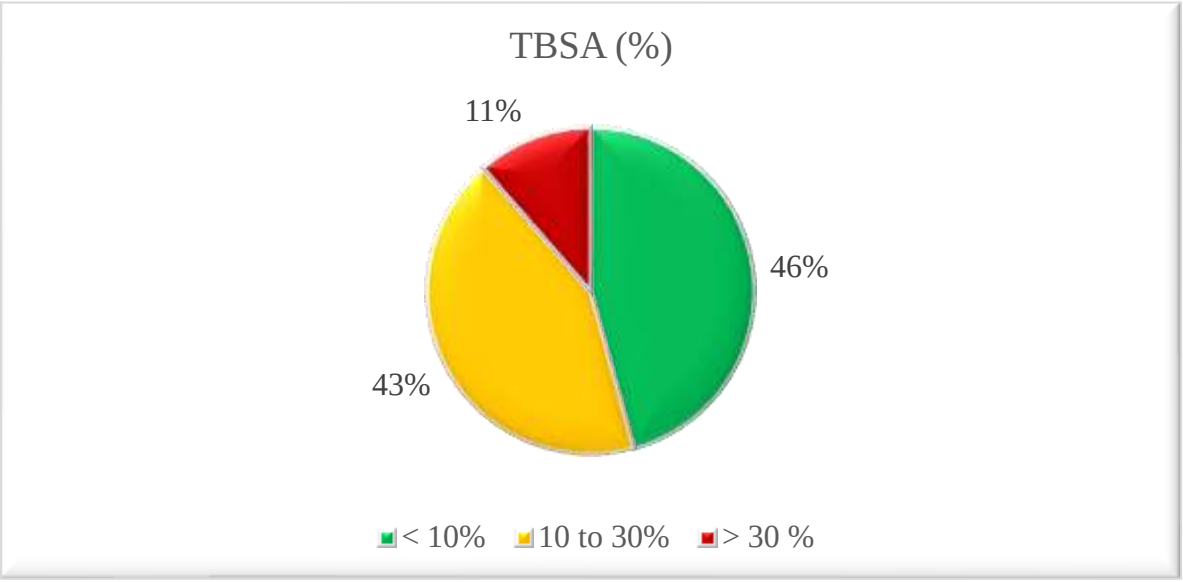
Flame burns were the second most common cause, affecting 8 of 35 children (22.85%). Among them, 5 children (1–5 years) sustained burns from lit lamps and camphor, while 3 children (6–10 years) were injured by fireworks and sparklers. Additionally, 2 children suffered burns from hot object contact and chemical exposure (paint thinner).

Table 2: Distribution of burn sources in pediatric cases

Sources	No of patients	Percentage
Water	14	40.0%
Flame	5	14.3%
Milk	5	14.3%
Cracker burst	3	8.6%

Tea	3	8.6%
Oil	2	5.7%
Paint thinner	1	2.9%
Silencer burns	1	2.9%
Coffee	1	2.9%

Figure 3: Distribution of pediatric burn cases by TBSA



Of the 35 children, 45.7% (16 patients) sustained burns covering <10% TBSA, while 55.3% (19 patients) had burns ≥10% TBSA, with 15 of these 19 sustaining >14% TBSA burns. All children with ≥10% TBSA burns were admitted to the Pediatric ICU for continuous monitoring and care (Figure 3). Among the 35 children, 5 (14.2%) required skin grafting, all of whom had extensive burns (≥25% TBSA) involving deep second- to third-degree burns. Of these, 2 sustained scald burns (hot water and oil), 2 had flame burns, and 1 suffered chemical burns (paint thinner). The timing of split-thickness skin grafting (SSG) varied, occurring on post-burn days 5, 8, 10, 16, and 26, with a mean grafting time of 13.00 ± 8.31 days.

The average hospital stay was 9.68 ± 9.5 days. Children not requiring skin grafting had a mean stay of 6.2 ± 3.07 days, while those undergoing grafting required a significantly longer 30.6 ± 7.63 days. Among the 19 children with burns ≥10% TBSA, the mean hospital stay was 13.89 ± 11.18 days, including those who required skin grafting.

DISCUSSION

Pediatric burns are among the most common childhood injuries, ranking fifth in non-fatal injuries worldwide. In India, an estimated 6–7 million burns occur annually [4], with pediatric cases accounting for 40% of hospital admissions. However, underreporting and the lack of organized burn care obscure the true burden.

Age & Gender: In this study, the most affected age group was 1–5 years (74.3%), aligning with previous findings that attribute this to young children's curiosity, impulsiveness, and exposure to household hazards.[5] The incidence declined with age as awareness of potential dangers increased. Key risk factors include lack of supervision, unsafe household practices, and traditional steam inhalation methods. Infants (<1 year) had the lowest incidence (2.9%), likely due to their dependence on caregivers. A prospective study at VMMC & Safdarjung Hospital, New Delhi, reported that 1–5 years was the most affected group (44.7%) [6], while Sharma et al.[7] found a similar trend (55.9%). In our study, burns were slightly more common in males (51.4%) than females (48.6%), a pattern also observed by Peddi M et al. [6] (male: 68.9%) and Sharma et al. [7] (male: 59.7%). This may be attributed to the higher activity levels and exploratory behaviour of boys.

Burn Type and Causes: Scald burns were the most common type (71.4%) in this study, predominantly affecting children aged 1–5 years (80%), with hot water being the primary cause (60%). A significant proportion of scald injuries resulted from accidental spillage during steam inhalation, a traditional practice for nasal congestion relief. Similar findings were reported in a tertiary care center in India, where 73.2% of pediatric burn cases were scald injuries, often due to accidental hot liquid spillage.[5] Sharma et al. [7] also observed that 48% of burn patients sustained scalds, with tea or hot milk being the most common causative agents. Flame burns (22.9%) were the second most common type, largely associated with household rituals and festive activities. Younger children (1–5 years) sustained burns from lit lamps and camphor, whereas older children (6–10 years) were injured by fireworks and sparklers. These findings emphasize the importance of preventive measures during cultural and religious events. Chemical and contact burns were infrequent (2.9%), often involving exposure to hot metal objects and paint thinner. A study from an Indian tertiary care hospital reported 38 pediatric cases of chemical burns over a 10-year period.[8] Electrical injuries accounted for 7.5% of cases in the study by Dhopte A et al.[5]

Extent of Burns: Burn severity was categorized based on total body surface area (TBSA) involvement, with 45.7% of children sustaining burns <10% TBSA and 55.3% having ≥10% TBSA burns, necessitating Pediatric ICU admission for intensive care. Sharma et al. [7] reported 21% of cases with <10% TBSA burns, while 58% had burns ranging from 10–13% TBSA. Dhopte A et al.[5] found that 55.8% of pediatric burns involved 10–30% TBSA, with older children exhibiting greater TBSA involvement on multivariate regression analysis. [2,9] Full-thickness burns were reported in only 8.6% of cases by Dhopte A et al.[5] Such burns typically occur when children are not rescued in time, leading to prolonged exposure to the causative agent.[10]

Management: Skin grafting was required in 14.2% of cases, primarily in patients with extensive burns (≥25% TBSA) and deep second- to third-degree burns. The mean time to split-thickness skin grafting (SSG) was 13.00 ± 8.31 days, similar to reported timeframes in other pediatric burn studies. [11-13] Delays in grafting were often due to wound bed preparation, secondary infections, or the need for multiple surgeries.

Hospital Stay and Rehabilitation: The overall mean hospital stay was 9.68 ± 9.5 days. Children not requiring grafting had significantly shorter hospital stays (6.2 ± 3.07 days) compared to those undergoing grafting (30.6 ± 7.63 days). Among children with burns ≥10% TBSA, the mean stay was 13.89 ± 11.18 days. This trend is consistent with literature indicating that greater burn severity and surgical intervention contribute to prolonged hospitalization.[14] Early wound healing and rehabilitation were prioritized, but children requiring grafting needed multiple surgeries for wound inspection and additional grafting procedures, prolonging their hospital stay. The need for extended care in such cases underscores the importance of optimizing wound management strategies to minimize hospital stay while ensuring functional recovery.

First Aid: Burn management in children is complex, requiring age-specific care, parental counseling, and rehabilitation. Early intervention by first responders and paramedics plays a critical role in optimizing outcomes. Delayed hospital presentation is common due to low awareness, social factors, reliance on home remedies, and socioeconomic constraints. First responders, usually parents, play a key role in initial management by removing the child from danger, taking off clothing and constrictive ornaments, extinguishing flames, cooling burns with room-temperature water, and seeking emergency care. [11] Burn wounds are initially sterile, but delayed presentation increases infection risk, necessitating a standardized empirical antibiotic protocol. ICU care is required for neonates with <5% TBSA, children 1–5 years with 5–10% TBSA, and older children with >10% TBSA. Despite appearing stable at admission, deterioration can occur rapidly, making parental counseling crucial to emphasize continuous monitoring and intervention. . Dhopte A et al.[5] highlighted poor societal knowledge regarding burn first aid, with only 57% of patients receiving cold water treatment, while others were treated with inappropriate remedies such as medicinal creams, ice, ink, potato, Ratan Jot (alkanet), and toothpaste. This underscores the need for public education on proper burn management.

IN HOUSE MANAGEMENT:

Debridement and Secondary Assessment: Burn depth is often underestimated due to devitalized epidermis, which also increases infection risk. Debridement under anesthesia in a sterile setting is essential for accurate assessment. Dressing selection depends on burn severity, with collagen dressings for superficial burns and silver-impregnated dressings for deeper wounds. Findings are documented using the Lund and Browder chart, while burn reconstruction aims to restore function and aesthetics.[15-17] Parental counseling is crucial, as misconceptions about anesthesia often cause hesitation.

Follow-Up and Wound Inspection: Post-debridement, regular monitoring is needed, with secondary debridement as required. Bedside or anesthesia-assisted wound inspection depends on factors such as burn extent, pain tolerance, and hemodynamic stability. Under-anesthesia inspection allows for simultaneous debridement.

Early Skin Grafting: Burn wounds risk hypertrophic scarring and contractures, affecting function. Early grafting prevents these complications. Further management includes splinting, functional positioning, and specialized finger dressings to prevent syndactyly.

Nutritional Support: Early enteral feeding (within 24–48 hours) reduces hypermetabolism, preserves gut integrity, and prevents bacterial translocation. Children with poor intake may require Ryle's tube feeding, with nutritional plans tailored to caloric needs, healing progress, and metabolic demands. [18]

Electrical Burns: Children's curiosity leads to electrical burn risks, often more severe than they appear. High-voltage injuries may cause compartment syndrome, necessitating fasciotomy. Vascular damage can lead to progressive tissue necrosis, requiring debridement, grafting, or even amputation. Monitoring for rhabdomyolysis and early intervention is critical.[5]

Firecracker Injuries: Seasonal firecracker-related burns spike during Diwali, primarily due to direct heat, blast injuries, and chemical exposure. Management involves meticulous decontamination, specialized burn care, and surgical intervention, particularly for hand and eye injuries. Public awareness and safety education can significantly reduce these injuries.[5,9]

POST-HOSPITAL MANAGEMENT

Discharge and Reintegration: Children are discharged once hemodynamically stable and wounds have healed, with the goal of reintegrating them into society as independent, functional individuals.

Psychological Rehabilitation: Burn injuries can lead to PTSD and body image issues. Comprehensive counseling, psychosocial rehabilitation, and parental education on emotional support are crucial for recovery.[19-21]

Physical Rehabilitation: Active and passive physiotherapy helps prevent contractures and joint stiffness. Parents should encourage limb usage, while splinting and range-of-motion exercises should be initiated early. School-going children should be taught self-care techniques to minimize complications.[21]

Burn Scar Management: Burn scars have lasting physical and psychological effects. Preventive measures include avoiding direct sunlight, using silicone-based scar therapies, and monitoring scars until maturation. Compression garments and massage help reduce hypertrophic scarring.

Long-Term Follow-Up: Regular follow-ups are necessary to detect complications such as contractures and chronic wounds. Early interventions, including contracture release surgeries, can improve long-term outcomes.

Prevention of Burn Injuries: Nationwide awareness is vital for burn prevention. Key measures include educating children on hazards, keeping flammable materials out of reach, supervising high-risk areas, avoiding unsafe steam inhalation methods, and enforcing safety regulations during Diwali and firework-related activities.

Photography in Burn Management: Photography is a valuable tool for patient counselling and medical documentation. It helps parents understand the need for hospitalization, enables comparison of treated versus untreated burns, and aids in monitoring healing progress and surgical planning.

CONCLUSION

Burns are a debilitating trauma across all age groups, with children being particularly vulnerable due to their inquisitive nature, lack of fear, and dependence on caregivers. Scald burns from hot water, whether for bathing or steam inhalation, are increasingly common. Children undergoing steam inhalation are often in a compromised state due to illness, making them more prone to accidents. The continued use of traditional steam inhalation methods, rather than commercial vaporizers, frequently leads to burns on the face, neck, and trunk due to accidental spillage from shallow vessels.

Parental counselling remains a critical yet often overlooked aspect of burn prevention and management. Many caregivers underestimate the severity of burns, necessitating education on the skin's thermoregulatory and barrier functions as part of comprehensive counselling. Beyond wound healing, addressing the psychosocial impact is essential to ensure the child's reintegration into daily life.

This study underscores the need for a multidisciplinary approach in burn management, involving plastic surgeons, pediatricians, intensivists, physiotherapists, psychiatrists, psychologists, nutritionists, and nurse practitioners. Emphasizing preventive measures and parental awareness is crucial in reducing the incidence and severity of pediatric burns.

REFERENCES:

1. Asefa L, Abebe MW, Negussie AG. Patterns and outcomes of pediatric burn injuries in a tertiary hospital's burn unit. Burns Open. 2024 ;8(2):87-91.
2. Sharma RK, Parashar A. Special considerations in paediatric burn patients. Indian journal of plastic surgery. 2010 ;43(S 01):S43-50.
3. Nassar JY, Al Qurashi AA, Albalawi IA, Nukaly HY, Halawani IR, Abumelha AF, Al Dwehji AM, Alhartani MM, Asaad A, Alnajashi A, Khojah IM. Pediatric burns: a systematic review and meta-analysis on epidemiology, gender distribution, risk factors, management, and outcomes in emergency departments. Cureus. 2023 ;15(11).
4. Gupta JL, Makhija LK, Bajaj SP. National programme for prevention of burn injuries. Indian journal of plastic surgery. 2010;43(S 01):S6-10.
5. Dhopte A, Tiwari VK, Patel P, Bamal R. Epidemiology of pediatric burns and future prevention strategies—a study of 475 patients from a high-volume burn center in North India. Burns & trauma. 2017 ;5.
6. Peddi M, Segu SS, Ramesha KT. The persistent paradigm of pediatric burns in India: an epidemiological review. Indian Journal of Burns. 2014 Jan 1;22(1):93-7.
7. Sharma A, Kumar A, Yadav U, Singh K. An epidemiological study of pediatric burns at a tertiary care centre of north India. Int J Acad Med Pharm. 2023;5(3):1459-63.
8. Ramakrishnan MK, Mathivanan T, Jayaraman V, Babu M, Shankar J. Current scenario in chemical burns in a developing country: Chennai, India. Ann Burns Fire Disasters. 2012;25(1):8–12.
9. Verma SS, Srinivasan S, Vartak AM. An epidemiological study of 500 paediatric burn patients in Mumbai, India. Indian Journal of Plastic Surgery. 2007;40(02):153-7.
10. Powar RS, Sudhir BM, Prabhu MD, Rajput DU, Mallapur BN. Epidemiological study of pediatric burns at a tertiary care centre in South India. Int J Community Med Public Health. 2016;3:1242–6.
11. Shrivastava P, Goel A. Pre-hospital care in burn injury. Indian Journal of Plastic Surgery. 2010; 43(S 01):S15-22.
12. Strobel AM, Fey R. Emergency care of pediatric burns. Emergency Medicine Clinics. 2018 ; 36(2):441-58.
13. Demir S, Oztorun CI, Erturk A, Guney D, Ertoy A, Doruk H, Tanriverdi F, Azili MN, Senel E. Approaches of emergency department physicians to pediatric burns: A survey assessment. Journal of Burn Care & Research. 2022;43(1):115-20.

14. Ryan CM, Schoenfeld DA, Thorpe WP, Sheridan RL, Cassem EH, Tompkins RG. Objective estimates of the probability of death from burn injuries. New England Journal of Medicine. 1998 ;338(6):362-6.
15. Klasen HJ. A review on the nonoperative removal of necrotic tissue from burn wounds. Burns. 2000 May 1;26(3):207-22.
16. Shelley OP, Van Niekerk W, Cuccia G, Watson SB. Dual benefit procedures: combining aesthetic surgery with burn reconstruction. Burns. 2006 ;32(8):1022-7.
17. Bhananker S, Krishnamoorthy V, Ramaiah R. Pediatric burn injuries. International Journal of Critical Illness and Injury Science. 2012 ;2(3):128-128
18. Xiao SC, Zhu SH, Xia ZF, Lu W, Wang GQ, Ben DF, Wang GY, Cheng DS. Prevention and treatment of gastrointestinal dysfunction following severe burns: a summary of recent 30-year clinical experience. World journal of gastroenterology: WJG. 2008 ;14(20):3231.
19. De Sousa A. Psychological aspects of paediatric burns (a clinical review). Annals of burns and fire disasters. 2010 ;23(3):155.
20. Martin A, Volkmar FR, Lewis M, editors. Lewis's child and adolescent psychiatry: a comprehensive textbook. Lippincott Williams & Wilkins; 2007.
21. Ohgi S, Gu S. Pediatric burn rehabilitation: Philosophy and strategies. Burns & trauma. 2013 ;1(2):2321-3868.