

Pediatric Burns During the COVID-19 Pandemic: A Single-Center Experience

Ayse Ebru Abali,^{1,2} Cem Aydoğan,^{1,2} Nigar Turkmen,¹ Mehmet Haberal^{1,2}

ABSTRACT

OBJECTIVES: We documented children treated at our burn center during the COVID-19 pandemic period to investigate the features of pediatric burns and burn care modalities within the influence of pandemic conditions.

MATERIALS AND METHODS: Medical records of 248 new admissions and 54 telemedicine visits were collected (March 2020-May 2021). Data collected included age, sex, burn cause, burn extent, affected body site, environment, time of day when injury occurred, time interval between injury and arrival at the burn center, and direct or indirect admissions from other centers. Collected data were also compared according to 2 different subgroups (age and treatment modality [outpatient/inpatient]). $P < .05$ was considered significant.

RESULTS: Male-to-female ratio was 1.07:1. Scalds were the most common burn cause (83.8%), most burns occurred at home (87.1%), and burn injuries mostly occurred between 1200 and 2400 hours (72.2%). Most children were brought to our burn center in the initial 3 days postburn (82.7%). The rate of direct admissions was 60.5%. Most patients were in the 0- to 2-year-old age group (53.6%). The number of admissions on the same day as injury was significantly greater for this age group compared with older groups. Outdoor burns were increased in older children (7- to 11-year-old group and 12- to 18-year-old group) ($P < .05$). Outpatients and inpatients comprised 87.5% and 12.5%, respectively. The mean total body surface area burned (minimum, maximum) was 2.0 ± 0.3 (0.1%, 50%) for outpatients

and $10.4 \pm 2.3\%$ (1%, 72%) for inpatients; mean length of hospital stay for inpatients was 9 ± 2.6 days (1, 77 days).

CONCLUSIONS: During the pandemic, burn injuries in children continued at the same rate. Meticulous COVID-19 protection is essential for continuity of expected quality in pediatric burn care. Telemedicine is advantageous, and progress on basic burn care guidelines, including telemedicine facilities, should be supported.

KEY WORDS: Children, Epidemiology, Pandemic, Pediatric injury, telemedicine

INTRODUCTION

Burn injuries are one of the most common causes of trauma in childhood. During the COVID-19 pandemic, most activities for children (including school, social activities, and sports) have been limited all around the world. However, despite “lockdowns” and “limited normal life” periods, emerging injuries to children have continued to require medical attention, with additive approaches for special protection from COVID-19 infection.¹ In this regard, our burn center has continued to serve without interruption during the COVID-19 pandemic. This includes our team working with the “safety strategy bundles for outpatient and inpatient burn care services,” which were established at the beginning of pandemic during March 2020.²

The aim of the present study was to document pediatric patients with burn injuries who were treated at our burn center during the pandemic period to investigate the influence of pandemic conditions on the characteristics of pediatric burn injuries and burn care modalities.

MATERIALS AND METHODS

At our burn center, located in Ankara (the capital of Turkey Republic), burn injuries to children up to 18 years of age comprise 35% to 48% of all burn cases annually. Our outpatient care division is used for both adults and children. The inpatient care service has 12 beds (4 beds for intensive

From the ¹Burn Center and Burn and Fire Disasters Institute, and the ²Department of General Surgery, Faculty of Medicine, Baskent University, Ankara, Turkey

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CORRESPONDING AUTHOR: Mehmet Haberal, Department of General Surgery and Burn and Fire Disasters Institute, Faculty of Medicine, Baskent University, Taşkent Cad. No:77, 06490 Bahçelievler, Ankara, Turkey

Phone: +90 312 2127293

E-mail: rectorate@baskent.edu.tr

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care), with 3 beds reserved for children; if there is a need, the adult beds and intensive care unit beds are also available for pediatric cases. Most of the pediatric patients with burn injuries seen at our center are urban dwellers who live in Ankara. However, because we are a verified burn center, moderate to major pediatric burn cases from rural areas, from all regions of our country, and from contiguous countries are also accepted.^{2,3}

From March 2020 to May 2021, 362 pediatric patients with burn injuries were treated as outpatients or inpatients in our burn center. Of these, 114 children had been injured before the beginning of the pandemic and had been on acute and long-term burn care management; 248 cases were new injuries that occurred during the pandemic. For this patient group of new admissions, a total of 1120 face-to-face visits and 54 telemedicine visits were performed.

For our study analyses, we included medical reports for the 248 new admissions, which also included medical reports for the 54 telemedicine visits. Collected data for each patient included age, sex, burn cause, burn extent, affected body site, environment (home or outside the home), time of day in which the injury occurred, and time interval between injury and arrival at the burn center. Data of direct or indirect admissions to our burn center from other medical centers were documented. The collected data were also compared for 2 different subgroups to compare differences according to age groups and according to treatment modalities (outpatient/inpatient).

Subgroups of age were created according to social and developmental activities in childhood. The 0- to 2-year-old age group were infants who were completely dependent on their parents or caregivers. During the lockdown and limited normal life periods (according to the progression of the pandemic), this age subgroup was mandatorily at home with their parents/caregivers. The 3- to 6-year age group comprised an age when children are curious and capable of self-directed activity but unaware of potential dangers of the environment. During the lockdown and limited normal life periods (according to the progression of the pandemic), this age subgroup was also mandatorily at home with their parents/caregivers. The 7- to 11-year-old subgroup comprised an age when children are active in new events but have limited awareness of dangers. In Turkey, they are the mandatory students of primary education. However, during the COVID-19 pandemic and especially during lockdown periods, they were mostly at home and participated in educational activities virtually from home. Virtual education has mostly continued even during the limited normal life periods for this age group. The 12- to 18-year-old age subgroup included adolescents who may be secondary school students or may be already

part of the labor force in different sectors. This group had virtual education during the lockdown, which continued during the limited normal life period.

Burn care modalities during the pandemic period were evaluated by the documentation of features of outpatients, inpatients, and telemedicine visits.

Statistical analyses

Results for quantitative variables are presented as means \pm SE (minimum and maximum). For distribution and evaluation of categorical data, Pearson chi-square tests with Monte Carlo exact test were used. *P* values $<.05$ were considered as significant.

RESULTS

Epidemiological characteristics of the whole study group

Of 362 pediatric admissions during the study period, our study group included 248 pediatric patients (68.5%). Boys comprised 51.6% ($n = 128$) and girls 48.4% ($n = 120$), with a male-to-female ratio of 1.07:1. With regard to the most common burn causes, 208 patients (83.8%) had scalds, 29 patients (11.7%) had contact burns, 4 patients (1.6%) had flame burns, and 7 patients (2.8%) had injuries characterized as "other." Sixty-eight patients (27.4%) had burns in the lower extremities, 57 (23%) had burns in the upper extremities, 56 (22.6%) had burns to the hands, 49 (19.8%) had head and neck burns, 49 (19.8%) had burns to the feet, and 48 (19.4%) had burns to the torso. Burns to the genital region (2.8%, $n = 7$ patients) was the most infrequently affected body site. The most common environment in which the injury occurred was the home (87.1%, $n = 216$), and burn injuries mostly occurred between 1200 and 2400 hours (72.2%, $n = 179$).

Most children (82.7%, $n = 205$) arrived to our burn center during the initial 3 days postburn, with 118 patients (47.6%) arriving on the day of injury. The rate of direct admissions was 60.5% ($n = 150$), with 39.5% of patients ($n = 98$) referred from other medical centers. The mean total body surface area (TBSA) burned was $3.0 \pm 0.41\%$ (minimum and maximum of 0.1% and 72%) for the whole study group.

Characteristics of patients according to age subgroups

Most of the pediatric patients included in our study were in the 0- to 2-year age group (53.6%, $n = 133$), followed by the 3- to 6-year age group (23.4%, $n = 58$), the 7- to 11-year age group (13.7%, $n = 34$), and the 12- to 18-year age group (9.3%, $n = 23$). There were no statistically significant differences in distribution of sex, time of day in

which the injury occurred, direct admissions to the burn center, and the chosen treatment modality (outpatient/inpatient) among the age subgroups. However, there were significantly more admissions on the same day of injury for children younger than 2 years compared with results shown in the older subgroups ($P < .05$). Although scald injuries were the most common burn cause for all age subgroups, contact burns were more common for children in the 0- to 2-year age group. No documented contact burn injury events were found in the adolescent group (ie, those 12- to 18-years old; $P < .05$). There were few flame burns among all age subgroups, with flame burns only observed in patients older than 3 years of age. Although the most common environment in which the injury occurred was the home for all age subgroups, the frequency of outdoor burns was greater in older children (7- to 11-year group

and 12- to 18-year group) ($P < .05$). Upper extremities, lower extremities, and feet were affected similarly in all age subgroups ($P > .05$). Burns to hand and head and neck occurred frequently in both the 0- to 2-year group and the 12- to 18-year group. Torso burns were more frequent in 0- to 2-age group, with few events in the oldest age group (12-18 years). Burns to the genital region occurred mostly in the 12- to 18-year group ($P < .05$) (Table 1).

Characteristics of patients according to burn care modalities

Of total study patients, 217 patients (87.5%) were outpatients and 31 patients (12.5%) were hospitalized. For outpatients, the mean TBSA burned was $2.0 \pm 0.3\%$ (minimum and maximum of 0.1% and 50%). For inpatients, the mean TBSA burned was $10.4 \pm 2.3\%$ (minimum and

TABLE 1. Characteristics of Patients According to Age Groups

	Age Group				Total
	0-2 years	3-6 years	7-11 years	12-18years	
No. of patients (%)	133 (53.6%)	58 (23.4%)	34 (13.7%)	23 (9.3%)	248 (100%)
Male/female ratio	1.12/1	1.23/1	0.88/1	0.64/1	1.07/1
No. of patients who arrived on same day as injury (%)	77 (57.9%)	26 (44.8%)	10 (29.4%)	5 (21.7%)	118 (47.6%)
No. of direct admissions (%)	80 (60.2%)	38 (65.5%)	18 (52.9%)	14 (60.9%)	150 (60.9%)
Burn cause, No. (%)					
Scalds	111 (83.5%)	51 (87.9%)	28 (82.3%)	18 (78.3%)	208 (83.8%)
Contact	20 (15%)	6 (10.3%)	3 (8.8%)	0	29 (11.7%)
Flame	0	1 (1.7%)	1 (2.9%)	2 (8.7%)	4 (1.6%)
Other	2 (1.5%)	0	2 (5.9%)	3 (13%)	7 (2.8%)
Time of injury, No. (%)					
0000-1200	44 (33.1%)	9 (15.5%)	10 (29.4%)	6 (26.1%)	69 (27.8%)
1200-0000	89 (66.9%)	49 (84.5%)	24 (70.6%)	17 (73.9%)	179 (72.1%)
Environment of injury, No. (%)					
Home	124 (93.2%)	49 (84.5%)	27 (79.4%)	16 (69.6%)	216 (87.1%)
Outdoors	9 (6.7%)	9 (15.5%)	7 (20.5%)	7 (30.4%)	32 (12.9%)
Mean TBSA \pm SE, %	2.48 ± 0.31	2.89 ± 0.63	2.47 ± 0.52	6.72 ± 3.65	2.96 ± 0.41
Body site of burn, No. (%)					
Head and neck	30 (22.56%)	6 (10.3%)	4 (11.8%)	9 (39.2%)	49 (19.76%)
Hands	39 (29.3%)	9 (15.5%)	2 (5.9%)	6 (26.1%)	56 (22.6%)
Upper extremities	35 (26.3%)	14 (24.1%)	5 (14.7%)	3 (13%)	57 (23%)
Feet	23 (17.3%)	16 (27.6%)	8 (23.5%)	2 (8.7%)	49 (19.8%)
Lower extremities	28 (21.1%)	22 (37.9%)	12 (35.3%)	6 (26.1%)	68 (27.4%)
Torso	35 (26.3%)	8 (13.8%)	4 (11.8%)	1 (4.3%)	48 (19.4%)
Genital region	0	1 (1.7%)	2 (5.9%)	4 (17.4%)	7 (2.8%)
Treatment modality, No. (%)					
Outpatient	115 (86.5%)	51 (87.9%)	31 (91.2%)	20 (87%)	217 (87.5%)
Inpatient	18 (13.5%)	7 (12.1%)	3 (8.8%)	3 (13.7%)	31 (12.5%)

Abbreviations: TBSA, total body surface area

maximum of 1% and 72%) and the mean length of hospital stay was 9 ± 2.6 days (minimum and maximum of 1 and 77 days).

Distributions of age, sex, time intervals between injury and arrival at burn center, rate of direct admissions to burn center, burn cause, and the time period in which the injury occurred were similar for outpatients and inpatients ($P > .05$). Although the distribution of affected body sites was mostly similar, 12.9% of inpatients ($n = 4$) had burn injuries to the genital region, whereas only 3% of outpatients ($n = 4$) had genital burns. All inpatients were injured at home except for 1 adolescent (72% TBSA burned) with flame burns that occurred at a workplace and 1 toddler (22% TBSA burned) with scalds that occurred at his grandparent's garden at rural side; in the outpatient group, 30 patients (13.8%) were injured in environments outside the home ($P < .05$) (Table 2).

During the hospitalization period, all inpatients required intravenous fluid replacement and monitoring in the emergency phase. In the acute phase, 3 patients needed additional albumin transfusions, 4 patients needed fresh frozen plasma, and 4 patients needed erythrocyte suspension transfusions. Antibiotics were used for 8 inpatients (25.8%) parenterally for sepsis ($n = 1$), pneumonia ($n = 1$), urinary tract infection ($n = 1$), and wound infection detected at admission ($n = 5$). Two patients underwent repeated split-thickness skin grafting surgeries; others were treated with repeated debridement and/or wound dressing changes. Although investigated at admission and

when suspected, no positive COVID-19 polymerase chain reaction tests were detected among the inpatients. All inpatients have survived, and they are currently under our long-term follow-up program.

Outpatients were treated with debridement and/or wound dressing changes; only 2 toddlers (0.9%) had to use oral antibiotics due to wound infections detected and confirmed by swap cultures at admission. Although investigated when suspected, there were no positive COVID-19 polymerase chain reaction tests among the outpatients. Parents of 2 patients whose wounds were totally epithelized with no need for wound dressing changes acknowledged the team by phone that they were under quarantine because of COVID-19-positive test results, which had been performed elsewhere. These cases were then subsequently followed by telemedicine methods.

Telemedicine visits ($n = 54$) were conducted for 37 children. Telemedicine via E-mail and phone calls included photographic follow-up visits for scars, treatment of contact dermatitis, and control checks of wound dressing. Almost the whole telemedicine service was carried out in the early "lockdown" period from March 2020 to May 2020. The 4 interurban children who could not travel to Ankara from their home towns were also treated via telemedicine methods in the following months.

During the pandemic period, 4 people from our burn team tested positive for COVID-19 within different time periods and without contaminating the other team members.

DISCUSSION

The COVID-19 pandemic resulted in extraordinary social conditions that limited children's activities even more than adults. Children and adolescents stayed at home for months and had multiple interruptions to their education programs, athletics, and play activities. These changes to the social lives of children may have resulted in some consequences to their mental and physical health conditions. Some authors have reported significant increases in admissions of pediatric injuries, including burns, during COVID-19 days compared with admissions before the pandemic. In contrast, some others reported significant decreases to burns in children during the early lockdown period between March 2020 and May 2020.⁴⁻⁹ Our earlier study, which concerned the frequency of pediatric burns in the early lockdown and limited new normal life periods revealed that the numbers of pediatric cases did not change with these social life changes.¹⁰ However, we believe that the frequency of pediatric burn traumas differed among various regions and various timings, and more detailed data from various locations must be collected before discussing the real dimensions of the influence of the pandemic on frequency and nature of pediatric

TABLE 2. Characteristics of Patients According to Treatment Modality

	Outpatient	Inpatient
No. of patients	217	31
Male-to-female ratio	1.09:1	0.94:1
Burn cause, No. (%)		
Scalds	181 (83.4%)	27 (87.1%)
Contact	27 (12.4%)	2 (6.5%)
Flame	3 (1.4%)	1 (3.2%)
Others	6 (2.76%)	1 (3.2%)
Mean TBSA \pm SE, %	2.0 \pm 0.3	10.4 \pm 2.3
Body site of burn, No. (%)		
Head and neck	35 (16.1%)	14 (45.2%)
Hands	49 (22.6%)	7 (22.6%)
Upper extremities	48 (22.1%)	9 (29%)
Feet	41 (18.9%)	8 (25.8%)
Lower extremities	56 (25.8%)	12 (38.7%)
Torso	44 (20.3%)	4 (12.9%)
Genital region	3 (1.4%)	4 (12.9%)

Abbreviations: TBSA, total body surface area

burns. Nevertheless, our present study served a purpose by giving some descriptive details on the issue.

The present study revealed that, among children treated at our burn center during the pandemic period, scalds were the most common burn injury (83.8%). This finding was similar to many series that were published before the COVID-19 pandemic.^{3,11-15} However, the high occurrence of contact burns among young children may indicate the inevitable diminishment in attention of caregivers during the long, busy, and anxious lockdown period. Many parents had to work from home via virtual methods; they had to leave their children with elderly grandparents, or they had to leave them home alone. The frequent occurrence of burn injuries between 1200 and 2400 hours supports this suggestion, with daily activities irregular and delayed for many children.

According to our results, pandemic conditions did not seem to cause a significant change in the most common environment in which burn injury occurred. The home continued to be the leading environment for pediatric burns, as it was in the past.^{3,15} The very low frequency of outdoor burns in young children in our study may be the result of discretion of caregivers regarding the stay at home precautions. Our results revealed that caregivers acted quickly in seeking medical attention despite pandemic limitations. Many patients in our study were admitted to a medical center on the same day as the injury, with most arriving at our burn center during the initial 3 days after injury. These results were in contrast to some reports from different regions of the world, which reported delays to pediatric trauma admissions during the pandemic period.^{4,9} The rate and speed of direct admissions to our burn center were satisfactory, considering the pandemic conditions.

It is well-known that most pediatric patients with burn injuries are treated as outpatients.¹⁶ Our results indicated that the pandemic did not influence this statistic among our patients, with most of our study patients treated as outpatients. This result was similar to that shown both before the pandemic and early during the pandemic.^{3,10}

Our burn center has been using telemedicine for referrals or consultations between our medical centers located in different cities of Turkey for more than 10 years.¹⁷ During the lockdown periods, the telemedicine methods were efficient for our outpatient services, such as follow-up visits of scars, treatment of contact dermatitis, and checks for wound dressing for children under quarantine. Other burn centers have also reported the advantages of telemedicine during the COVID-19 pandemic.¹⁸ These experiences reveal that telemedicine can be a cost-effective alternative during disasters as well as standard care for burn care facilities.^{17,19} We believe that telemedicine must be integrated as standard burn care in the future.

The admission rates and features of children who had to be hospitalized were similar to the past burn injury experiences of our burn center.³ Our first-, second-, and third-degree precautions for patients and staff, a reduced numbers of beds to ensure safe distances between patients, and protection precautions for surgical procedures with limited permissions of entrance into inpatient areas provided this uninterrupted and qualified inpatient burn care for children during the pandemic.²

CONCLUSIONS

The COVID-19 pandemic has created extraordinary conditions in our lives all over the world, and the present results suggested that our burn center continued to treat children with burn injuries at a similar rate. Meticulous application of COVID-19 protection precautions is essential for steadiness of expected quality of burn care for children. Telemedicine is an advantageous method under pandemic conditions. Progress in telemedicine care, based on pandemic experiences, should be supported to upgrade basic burn prevention strategies; pediatric burn care guidelines should include telemedicine in the future.

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