

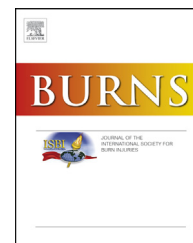


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Changes in the epidemiologic profile of burn patients during the lockdown in Catalonia (Spain): A warning call to strengthen prevention strategies in our community

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ABSTRACT

Background: The worldwide coronavirus disease 2019 (COVID-19) epidemic, caused by the SARS-CoV-2 coronavirus, is the defining global health crisis of our time. Spain has had one of the highest burdens of COVID-19 worldwide.

During this period, Vall d'Hebron University Hospital Burn Center (Barcelona) has faced a unique challenge: supporting the hospital response against COVID whilst continued offering an optimal care to the burn patient.

Objective: The aim of this study is to characterize the clinical and epidemiological characteristics of acute burn patients who received urgent health care or admission to the our Burn Center during the mandatory confinement period in Spain forced by the COVID-19 epidemic.

Methods: We analyzed the medical records of burn patients who received urgent care and/or admission to our Burn Center during the mandatory confinement period in Spain (Period 1: from March 14th to May 9th, 2020) and during the same period of the last year (Period 2: from March 14th to May 9th, 2019). Both groups were compared in order to find differences in the epidemiologic profile of burned patients.

Results: A total of 350 burns cases were analyzed. A 36% reduction in the number of emergency department visits was identified during Period 1. However, we found an increase in the rate of hospital admissions in Period 1 (20% of the burn cases) compared with Period 2 (13% of the burn cases). Seventy-six burn-related primary admissions were analyzed: 37 patients were admitted during Period 1 and 39 patients during Period 2. No differences were found between the two periods in the proportion of patients that underwent surgical treatment: 59.5% of patients admitted during Period 1 and 61.5% of patients admitted during Period 2. A statistically significant increase was noted in the rate of paediatric (aged 0–16 years old) admissions during Period 1 (40.54%, n = 15) compared to Period 2 (20.5%, n = 8). Among paediatric patients, an increase in the rate of surgical procedures was noted in Period 1 (47% of children), compared with Period 2 (37% of children). Proportion of patients that were

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admitted to the Intensive Care Unit was higher among burn children admitted during period 1 (46.7%, $n = 7$) than those admitted during Period 2 (25%, $n = 2$). Among the 37 patients admitted during the lockdown period, two positive COVID-19 patients were confirmed.

Conclusions: This study gives an overview of the clinical and epidemiologic profile of burned patients during the stringent lockdown in Spain forced by the COVID-19 epidemic. Our data shows a stable trend in the number of burn-related admissions and burn related-surgeries during the confinement period. A significant increase in the rate of burn children admitted and an increase in the severity of injuries in this population is noted. These data must be taken in account in the development of strategies to ensure the maintenance of Burn Centers function in extremely situations such as the current epidemic. A lack of effective burn prevention campaigns in our environment has been noted and the development of focused prevention strategies is a priority.

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1. Introduction

The worldwide coronavirus disease 2019 (COVID-19) epidemic, caused by the SARS-CoV-2 coronavirus, is the defining global health crisis of our time. Spain, with more than 716,500 cases and 31,230 deaths as of September 28, 2020, has had one of the highest burdens of COVID-19 worldwide [1,2].

Community spread of the virus in Spain began in the first two weeks of March. In response, the government used a royal decree (463/2020) [3] to declare a State of Emergency and implemented a mandatory confinement, starting on March 14th, 2020. April 2nd saw the peak of fatalities in Spain, with 950 deaths reported by the Spanish health authorities.

The Vall d'Hebron University Hospital (Barcelona) is the largest hospital in Catalonia with more than 1100 beds and has Spain's largest critical patient area. On March 31, 2020 our hospital reported the highest number of COVID-19 patient admitted: 632 cases in COVID-wards and 168 patients in the intensive care unit (ICU). 90% of the hospital resources were dedicated to the treatment of patients suffering the disease.

During this period, our Burn Center faced a unique challenge: supporting the hospital response against COVID by becoming one of the only two non-COVID intensive care areas of the whole hospital (besides the pediatric ICU), whilst continued offering an optimal care to the burn patient. The Vall d'Hebron Burn Center is a 26-bed facility EBA-verified Burn Center and provides assistance to a population of approximately 8 million people. An average of 2500 patients are referred every year and approximately 550 patients are admitted per year in our Unit.

The aim of this study is to characterize the clinical and epidemiological features of acute burn patients who received urgent health care or admission to our Burn Center during the mandatory confinement period in Spain. We compared this group with burn patients who received urgent care or admission to the Burn Unit during the same period of the previous year in order to identify the differences in the epidemiologic profile of burn patients during the lockdown period. Furthermore, we searched for detailed identification of burn etiology and mechanism of injury in order to develop future focused prevention strategies.

2. Material and methods

A retrospective single-center study was conducted. We reviewed the medical records of burn patients who received urgent care and/or admission to our Burn Center during the mandatory confinement period in Spain (Period 1: from March 14th to May 9th, 2020) and during the same period of the previous year (Period 2: from March 14th to May 9th, 2019). In order to assure that 2019 was a good representation of the typical admissions numbers, we reviewed the number of adult and pediatric patients that were admitted in our Burn Center during the same time period of 2016, 2017 and 2018. We observed a stable trend in the data above mentioned, so we considered that 2019 was representative of a normal year in terms of burn admissions numbers in our Center. For each patient were analyzed the following variables: Age and gender, date of admission to the Burn Unit, total body surface area (TBSA) burned, burn depth, burns involving head or neck, number of surgical procedures, intensive care utilisation, inhalation injury, days of hospitalization and COVID PCR test result. The burn etiology, mechanism of injury and the circumstances surrounding the accident were determined as far as possible in order to develop focused prevention strategies. Both groups were compared to explore if there were differences between them. Furthermore, we made a separate analysis of patients aged 0–16 years old.

2.1. Inclusion and exclusion criteria

All patients that suffered acute burns receiving attention in our Emergency Room or admission in our Burn Center during both periods were eligible for inclusion. All re-admissions, chronic injuries or non-burned patients were excluded.

2.2. Statistical methods

General descriptive analysis was conducted in order to characterize the groups. Measures of central tendency were used for quantitative variables and proportions for qualitative variables. For the comparison of the two groups (Period 1: mandatory confinement in Spain versus Period 2: same period of the previous year) we performed hypothesis contrast tests to determine if the observed differences were statistically

significant. The Chi-square test was employed to compare proportions; when data did not fulfill Chi-square requirements, Fisher's exact test was used. Student's T-test for independent groups was used to compare means when homoscedasticity was found; otherwise Mann–Whitney U test was used. We established a significance level for all tests of 95%.

3. Results

3.1. Burn emergencies

A total of 350 burn emergencies were analyzed: 136 during the Period 1 (lockdown period) and 214 during the Period 2 (same time period of 2019): an important reduction of the 36% in the number of emergency department visits was identified in Period 1.

We found an increase in the rate of hospital admissions in Period 1 (20% of burn emergencies) compared with Period 2 (13% of burn emergencies). No statistically significant differences were found in the mean TBSA among both groups. Scald was the predominant burn cause in both periods, followed by flame (Table 1).

3.2. Burn admissions

3.2.1. Burn patient admissions

Seventy-six burn-related primary admissions were analyzed: 37 patients were admitted during Period 1 and 39 patients during Period 2.

Scald burn was the most frequent type of burn in both periods, followed by flame. Concerning the mean percentage of TBSA affected, there were no significant differences between the two groups. There were not differences in the number of patients with major burns (>15% of TBSA) during both periods.

No differences were found between the two periods in the proportion of patients that underwent surgical treatment: 59.5% of patients admitted during Period 1 and 61.5% of patients admitted during the control Period 2 underwent at least one surgical procedure.

The mean length of hospital stay was higher during Period 2 (18.8 days) than Period 1 (15.9 days). Three patients (5.4%) were

admitted for a same-day surgery during the Period 1 and one patient (2.56%) during the Period 2.

Burn-related mortality rate in admitted patients was 2.56% ($n = 1$) during Period 2. During Period 1, we documented one COVID-related death, but any burn-related death.

Among the 37 patients admitted during the lockdown period, two positive COVID-19 patients were confirmed: a 3 years old girl with a 8% of TBSA burned with no sequelae and a 84 years old woman with a 5% full thickness burn on the back of the thighs who died after developing pneumonia secondary to COVID-19 (Table 2).

3.2.2. Pediatric patient admissions

A statistically significant increase was noted in the rate of pediatric patient (aged 0–16 years old) admissions during Period 1 (40.54%, $n = 15$) compared to the control Period 2 (20.5%, $n = 8$). Children aged 0–4 years were the most frequently admitted age category among pediatric patients during both periods. We noted a significant increase in the number of admitted children aged 5–10 years during Period 1 (40% of pediatric patients) compared to Period 2 (0% of patients).

Scald was the predominant burn cause in both groups and hot drinks were the main cause of scald burns.

No statistically significant differences were found in the mean TBSA burned among the two groups. During the confinement period, the number of children with major burns (affecting >10% of total body surface area) was higher (6 patients, 40%) compared with the control period (2 patients, 25%) however, no statistically significant differences were found.

During Period 1, 46.7% ($n = 7$) of children presented injuries involving head and neck area, compared with 25% ($n = 2$) of children burned during Period 2.

An increase in the rate of surgical procedures was noted in Period 1 (46.7% of children underwent at least one surgical procedure), compared with Period 2 (37.5% of children). Number of surgeries per patient were also greater during period 1 (0.6 surgical procedures per patient) compared with Period 2 (0.37 surgical procedures per patient).

Table 1 – Comparison of burn related emergencies between Period 1 (confinement period) and Period 2 (control period).

	Period 1	Period 2
N ^o of emergencies (n)	136	214
Mean age (years)	33.5	40.5
% of women	50%	48%
Mean % of TBSA burned	1.80%	2.37%
Scalds (%)	69%	80%
Flame (%)	21%	8%
Admissions (%)	20%	13%

Table 2 – Comparison of burn related admissions between Period 1 (confinement period) and Period 2 (control period).

	Period 1	Period 2
N ^o of admissions (n)	37	39
Mean age (years)	36	42.6
% of women	50%	52.4%
% of adults	59.4%	79.4%
Mean % of TBSA burned	11.30%	10%
Major burns (%) ^a	19%	18%
Scalds (%)	48.6%	48.70%
Flame (%)	40.50%	41%
Work related burns (%)	5.40%	5.10%
Surgical procedure (%)	59.50%	61.50%
Mean length hospital stay (days)	15.9	18.8

^a >15% of TBSA affected.

Proportion of patients that were admitted to the Intensive Care Unit was higher among burn children admitted during period 1 (46.7%, $n = 7$) than among those admitted during Period 2 (25%, $n = 2$).

Length of hospital stay was higher in children admitted during Period 1 (15.13 days) than those admitted during Period 2 (12.37 days) (Table 3).

4. Discussion

The present study aims to analyze the impact of the stringent lockdown forced by the COVID-19 epidemic in the epidemiologic profile of burn patients admitted in the largest Burn Center in Spain.

The Vall d'Hebron Burn Center has faced an unprecedented challenge during the current COVID-19 epidemic: On one hand, it became a non-COVID ICU admitting severely polytraumatized patients (including those with neurotrauma or acute spinal cord injury) and patients with other critical conditions, like sepsis. On the other hand, the center continued offering burn care to our big reference population (approximately 8 million people), striking a balance between contributing to the epidemic response and preserving ongoing burn care in a safe and ethical fashion, as previously recommended by international burn experts [4]. Under such circumstances, one of our main concerns was to maintain the Burn Unit as a free-COVID area. For this reason, from March 19, 2020 (when the number of COVID patients exponentially increased in the hospital), all the patients undergoing admission (either burn patients or non-COVID critically ill patients) were PCR-tested and isolated regardless of symptoms before their admission to our Burn Center. Isolation was maintained until negative results were confirmed. Due to this meticulous screening, we did not have any case of COVID-19 positive patient in our unit after March 19, preserving burn center function and non-COVID ICU function. Before March 19, two positive SARS-COV 2 patients were confirmed and transferred to a COVID area.

Concerning burn related emergencies, we registered a decrease in comparison with the same period of the previous year. This can be mainly explained due to the confinement of the population and the decrease of industrial activity and traffic accidents; furthermore, people who suffered minor

burns refrained from consult likely because they were fearful of visiting our hospital (where the incidence of COVID-19 admissions was the highest in Catalonia). Moreover, authorities advised to avoid unnecessary visits to hospital.

Despite the decrease in burn emergencies, the number of admissions showed a stable trend, even though we made an effort to limit patient admissions by prioritizing outpatient wound care, day case surgeries and telemedicine follow up whenever feasible (small, superficial and socially non-complex burns). Every decision was approved by the Head of Department and the Burn Center Coordinator to ensure that a high-standard service was provided to all the patients.

Any kind of elective surgery in the whole hospital was suspended in order to limit the capacity of COVID-19 to spread and optimize resources to treat COVID-19 patients. Nevertheless, acute burn surgeries were considered essential and proceeded as usual: 59.5% of burn patients admitted underwent at least one surgical procedure, almost the same proportion of patients that underwent surgery during the same period of the last year (61.5%).

The identification of a stable trend in the number of burn related hospital admissions and in the number of burn surgeries during the State of Emergency is an important finding that must be taken in account when preparing for a new COVID-19 outbreak or another global sanitary crisis. We suggest that every Burn Center should develop strategies to ensure the maintenance of its function in extreme situations such as the current epidemic. Furthermore, we agree with L.-P. Kamolz [5] and other burn experts from Germany, Austria and Switzerland that the triage and treatment of serious burn injuries must be independently of "COVID time" and should be performed always by burn experts.

One of the major findings in our study is the significant increase in the number of pediatric burn patients (<16 years old) admitted during the lockdown. We did not identify any factor that explains the increase in the pediatric patients' admissions, other than the mandatory confinement: all the regional pediatric centers remained opened and maintained their activity. In addition, we are the only reference center for pediatric burn patients in our whole reference region, that includes Catalonia, Balearic Islands (except Ibiza) and Andorra. This finding is consistent with those made by other authors [6,7]. That can be mostly explained by the strict confinement measures implemented in Spain (probably the strictest in Europe): children were not allowed to exercise outside, take walks or leave their house except for medical reasons, resulting in bored and psychologically exhausted children. This situation combined with parental burnout, who continued remotely working, may led to a lack of sustained or adequate supervision. Moreover, multiple studies suggest that most of the burns in children occur at home, where they are close to hot liquids and participate in tasks like cooking, ironing, etc. [8,9].

Additionally, we found that acute burn injured children admitted during the lockdown (Period 1) suffered more severe injuries compared to children admitted during the same period of the previous year:

- Median TBSA was higher in children admitted during Period 1. An increase in children with major burns (>10% TBSA) was also noted during Period 1.

Table 3 – Comparison of burn related pediatric admissions between Period 1 (confinement period) and Period 2 (control period).

	Period 1	Period 2
Nº of admissions (n) and proportion (%)	15 (40.54%)	8 (20.5%)
Mean age	4.47	2.25
Mean % of TBSA burned	9.8%	8%
Major burns (%) ^a	40%	25%
Scalds (%)	80%	100%
Flame (%)	20%	0%
Head and neck involvement	46.7%	25%
Surgical procedure (%)	46.7%	37.5%
Mean length hospital stay (days)	15.13	12.37
ICU stay	46.7%	25%

^a >10% of TBSA affected.

- Proportion of ICU stay was higher in this group. Length of hospital stay was also greater.
- This group underwent a greater rate of surgical procedures and a greater number of surgeries per patient.
- Burns involving head and neck were more frequent in this group.

The increase in the severity of injuries could be explained by multiple factors. During the lockdown, children spend much more time at home than usually and were more involved in domestic issues such as cooking or using the microwave. Furthermore, we noted an increase in flame burns from the ignition of clothing and misuse of inflammable substances. In addition, an increase in the number of burns among school-age children (over 4 years old) was noted during the confinement. Whilst scald burns are seen by most authors as the most common burn etiology among children aged 0–4 years old [10–15], flame burns are more common among older children, often due to fire play and risk-taking behaviors, resulting in larger and deeper burns [8,14,16,17].

Correspondingly, the proportion of adult patient admissions decreased during the study period (59.4%) compared to the control period (79.4%). We think this could be explained by the substantial decrease of work-related accidents (particularly those related with the catering sector and the industrial activity) and traffic accidents. We also found a decrease in the proportion of above 65 years age group admissions during Period 1 (16%) compared to Period 2 (30%). This fact could be related to the fact that this elderly people were better accompanied and taken care of by their relatives, who spent more hours at home.

Most burns are avoidable and therefore the main tools for prevention are education and legislation in society. However, the worrisome increase in the number of children admitted during the confinement period that received complex burn care, alerted us about the lack of effective prevention measures in our geographical environment, especially when compared with the multiple resources offered by the American Burn Association (ABA) on its website [18], as well as by the Children's Burns Trust, registered charity in England and Wales [19]. Furthermore, our investigation of burn incidents in children during both periods reveal a predominant burn cause (scald from hot drinks and cooking liquids) and repeated mechanisms of injury consisting in: (1) child pulling pans, mugs or kettles from cooker tops and tables (2), accidental spill of hot liquids when holding a young child and cooking or drinking hot beverages at the same time. Similar injury mechanisms have been also reported by other authors [15,20–22]. In addition, we observed a surge in scalds resulting from the practice of steam inhalation during the lockdown period, as a home method to prevent and treat respiratory infections. Other centers have also reported an increase in scalds relating to steam inhalation during the confinement [7,23].

During the lockdown period we made an online diffusion of recommendations for burn prevention via the Vall d'Hebron institutional Twitter account and staffs' Instagram. Furthermore, the Vall d'Hebron Hospital Website offers extensive recommendation and tips to avoid burn injuries and their

sequelae [24]. Nevertheless, currently no other prevention campaigns are published or spread in our community.

Our data demonstrates the need for continuously reviewing and evaluating epidemiology of burns in our community as well as developing and diffusing burn prevention programs. We recognize that preventing childhood burns at home is a long-term process, which requires a multi-action intervention. We are focusing our future efforts on: (1) introduce a school-based educational program throughout the diffusion of burn prevention videos and informative talks at schools (2), instauration of a "Burn Awareness Week" in our community, inspired in the National Burn Awareness Week developed by the ABA [25] (3), encourage media to offer regular announcement of burn injuries types and mechanisms and preventive measures (4), encourage pediatricians and pediatric nurses to advise and teach parents about the potential for kitchen scalds and other burns in young children.

Some limitations of this study are the retrospective observational design and the single center nature. It would be interesting to perform a multicenter study, however, the present one offers meaningful data about the epidemiological profile of burn patients during the current epidemic crisis, since it has been performed in the largest Burn Center in Spain.

5. Conclusions

This study gives an overview of the clinic and epidemiologic profile of burned patients during the stringent lockdown in Spain forced by the COVID-19 epidemic. Our data shows a stable trend in the number of burn-related admissions and burn related-surgeries during the confinement period. A significant increase in the rate of burn children admitted and an increase in the severity of injuries in this population is noted. This data must be taken in account in the development of strategies to ensure the maintenance of Burn Centers function in extreme situations such as the current epidemic. A lack of effective burn prevention campaigns in our environment has been noted and the development of focused prevention strategies is a priority.

Conflict of interest

The authors declare that there is no conflict of interest.

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