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Review of pediatric burn patients in critical care at a tertiary facility

Hakan Yalim [1], Sidika Deniz Yalim [2], Aysenur Boztepe [3]

[1] Department of Anesthesia and Reanimation, Adana City Training and Research Hospital, Adana, Turkey
[2] Department of Otorhinolaryngology, Adana City Training and Research Hospital, Adana, Turkey
[3] Department of Anesthesia and Reanimation, Dr. Lutfi Kırdar Kartal City Hospital, Istanbul, Turkey

ORCID of the author(s)

HY: https://orcid.org/0000-0002-2350-2252
SDY: https://orcid.org/0000-0001-7833-8421
AB: https://orcid.org/0000-0002-7021-240X

Corresponding Author
Hakan Yalim
Department of Anesthesia and Reanimation, Adana City Training and Research Hospital, Adana, Turkey
E-mail: yalimh01@hotmail.com

Ethics Committee Approval
The study was approved by the Ethics Committee of Dr. Lutfi Kırdar Kartal Education and Research Hospital (Date: 2008, Number: 53).
All procedures in this study involving human participants were performed in accordance with the 1964 Helsinki Declaration and its later amendments.

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No conflict of interest was declared by the authors.

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Abstract

Background/Aim: In Turkey, numerous individuals seek treatment every year for burn injuries due to socioeconomic conditions. This study aims to deliver insights into treatment strategies for pediatric burn patients in critical care settings in Turkey.

Methods: We retrospectively examined the medical records of 50 children, aged 0 to 14 years, treated in the Burn Intensive Care Unit. We analyzed the year of admission, age, gender, burn percentage, initial hematocrit and platelet levels, duration of stay in the critical care unit, and total hospital stay. We further assessed their mechanical ventilation duration, need for inotropic support, initial and 24-hour APACHE II scores, Glasgow Coma Scale (GCS), Sequential Organ Failure Assessment (SOFA) score, and mortality rates.

Results: Children who succumbed had significantly higher GCSs, admission and 24-hour APACHE II scores, burn severity, and required mechanical ventilation and inotropic support. These factors were linked to mortality (P<0.01). Mortality showed no correlation with age, gender, hematocrit, platelet counts, critical care stay duration, or SOFA score.

Conclusion: Factors such as burn severity, need for mechanical ventilation and inotropic support, GCSs, and APACHE II scores in pediatric burn patients in critical care may be associated with mortality and influence their prognosis.

Keywords: burns, intensive care, coma, APACHE

Introduction

Burn injuries, caused by heat, electricity, or chemicals, pose serious health challenges by damaging the skin's protective layers and subcutaneous tissue [1,2]. Thousands seek burn treatment every year due to socioeconomic factors, with severe cases referred to specialized facilities.

The Glasgow Coma Scale (GCS) is a widely utilized neurological tool for assessing dysfunction and predicting mortality within two weeks post-injury, with lower scores indicating more severe damage [3].

Introduced in 1981, the APACHE scoring system evaluates disease severity through a combination of variables. Knaus et al. [4] developed an index to assess mortality risk based on APACHE II, allowing for the use of baseline disease coefficients.

The Sequential Organ Failure Assessment (SOFA) was created in 1994 during a European Society of Critical Care Medicine and Emergency Medicine conference. It applies to both septic and non-septic patients [5-7].

This study investigates factors such as high burn percentage, dehydration, fluid-electrolyte imbalance, and the critical need for early fluid therapy to reduce morbidity and complications in pediatric burn patients.

Materials and methods

We retrospectively assessed the medical records of 50 children, 30 males and 20 females, aged 0 to 14 years, treated in the Burn Intensive Care Unit of Dr. Lutfi Kırdar Kartal Education and Research Hospital from December 2008 to December 2010. The study was approved by the local ethics committee of Dr. Lutfi Kırdar Kartal Education and Research Hospital (Date: 2008, No: 53) and adhered to the 1964 Helsinki Declaration. Informed consent was obtained from the parents of hospitalized children in the burn unit. This retrospective study involving human participants was found to be in accordance with all ethical standards.

Three children were discharged after their initial admission but required readmission. Of these, two died during the second admission, and one was discharged. The second admissions were excluded from statistical data, while the first were included. We analyzed admission year, age, gender, burn percentage, initial hematocrit and platelet values, critical care and hospital stay duration. We further examined the mechanical ventilation duration, inotropic support need, initial and 24-hour APACHE II scores, Glasgow Coma Scale, SOFA score, and mortality rates.

Statistical Analysis

We used the Number Cruncher Statistical System (NCSS) 2007 & PASS 2008 Statistical Software (Utah, USA) for statistical analyses. Descriptive statistics (mean, standard deviation) assessed the data, and the Mann-Whitney U test compared quantitative data without normal distribution between the two groups. The chi-square test compared qualitative data with significance determined at *P*-value <0.05.

Results

The study included 50 children aged 2 months to 13 years, with an average age of 3.31±2.98 years. A significant number had burns covering 20-30% of the body. Mechanical ventilation was used for half of the children, averaging 4.80±6.93 days. Septic shock was the leading cause of death for 81.8% of the children (Table 1).

No significant age (*P*=0.981) and gender (*P*=0.676) differences existed between the deceased and surviving children. The burn surface area was significantly higher in deceased children (*P*=0.005). Mortality was higher in children needing mechanical ventilation (*P*=0.001). There was no significant difference in mechanical ventilation duration (*P*=0.001), critical care stay duration (*P*=0.869), hospital stay duration (*P*=0.001), SOFA scores (*P*=0.127), hematocrit levels (*P*=0.386), and platelet counts (*P*=0.090). Survivors had significantly higher GCS (*P*=0.022). Deceased children had significantly higher APACHE II scores (*P*=0.001).

Table 1: Distribution of demographic features.

		Minimum-Maximum	Mean (SD)
Age		0.17-13.0	3.31 (2.98)
		Number	**Percentage**
Gender	Female	20	40
	Male	30	60
Year of admission	2008	1	2
	2009	16	32
	2010	33	66
Burn percentage (%)	< 20%	3	6.1
	20-30%	17	34.7
	30-40%	10	20.4
	40-50%	8	16.3
	50-60%	7	14.3
	60-70%	3	6.1
	> 70%	1	2

SD: Standard deviation

Discussion

In our study, 60% of patients were male and 40% were female. The existing research shows similar male-to-female ratios [8,9]. Patients averaged 3.31±2.98 years, consistent with other studies [8,10,11]. Minor burns were less common, while severe burns were more frequent, likely due to the hospital's referral status, limited burn knowledge, and outpatient treatment for burns under 10% unless they involved the face or neck [12-14].

Our study's stay duration matches Soltani et al. [15], influenced by early burn detection, home occurrence, smaller burn areas, and quicker death in children with extensive burns. However, Ryan et al.'s [16] study in Canada reported an average hospital stay of 16 days.

In the present study, 22% of patients died; however, mortality rates were higher in other studies [10,11,17]. Children's burn treatment differs due to fluid-electrolyte balance changes and body proportions, with high mortality attributed to limited burn care units, large patient intake, and inadequate care [18].

The primary cause of death was septic shock, similar to other studies [18-20], which differed from Kobayashi et al. [21]. Septic shock deaths were due to patient referrals, insufficient fluid therapy, poor hygiene, understaffed units, and antibiotic-resistant bacteria.

No relationship between age and mortality was found, but burn surface area was significantly related to mortality [22]. Early thrombocytopenia and suppressed thrombocytosis were

linked to increased mortality, but our study found no significant relationship with thrombocyte values [23].

APACHE II scores were associated with illness severity, longer hospital stays, and increased mortality. In our research, both initial and 24-hour APACHE II scores were significantly linked to mortality [24].

Organ failure scoring during sepsis aids in evaluating prognosis and treatment efficacy. The SOFA score's simplicity and reliability support its use, but no significant relationship with mortality was found in our study [25].

Inotropic support during mechanical ventilation influenced the clinical course, and a five-point APACHE II score increase resulted in a 1.8-fold mortality increase [26]. A low Glasgow Coma Scale (GCS) was linked to mortality [27].

Study limitations include a small sample size, lack of national representation, and limited insights into mortality and morbidity causes.

We believe juvenile burn victims are more susceptible to sepsis and fluid-electrolyte imbalances due to impaired skin integrity. Pediatric burn management differs from adult treatment due to fluid-electrolyte balance and body proportions. Addressing these factors can reduce morbidity and complications.

Conclusion

We highlight the importance of fluid therapy in pediatric burn patients, enhancing infection prevention against sepsis, and educating families on burn prevention. Further research is needed to explore survival outcomes in pediatric burn patients.

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