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Original Article

Characteristics and Outcomes of Patients Admitted to a Tertiary Pediatric Intensive Care Unit in Western Black Sea Region of Turkey

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Abstract

Objective*: To evaluate the demographic and clinical characteristics of patients admitted to a tertiary pediatric intensive care unit (PICU) in Karabuk, Western Black Sea Region of Turkey.*

Methods*: Patients admitted to the PICU between June 2023 and June 2024 were analysed retrospectively. It were evaluated age, gender, presence of chronic disease, reason for admission to the PICU, length of stay in both the intensive care unit and hospital stay, need and duration of high-flow nasal cannula (HFNC), need and duration of invasive mechanical ventilation, type of nutrition, need for inotropic drugs, the glasgow coma scale (GCS), nutrition, pretransport pediatric risk of mortality (PRISM) score and mortality rates.*

Results*: Forty-three (48.9%) of these patients were female. The median age of the patients was 4.5 years [1.0-12.75]. According to the intensive care unit hospitalisation diagnoses, 37 (42.0%) of the patients had respiratory distress at the highest rate. It was observed that 24 (27.3%) of the patients had a chronic disease. Mechanical ventilation support was required in 19.3% of patients admitted to PICU, and the mean duration of mechanical ventilation was 10.0 [1.5-50.0] days. GCS score was found to be significantly lower in the group with mortality (p= 0.004). PRISM scores of patients with mortality were found to be statistically significantly higher (p<0.001).*

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***Conclusion**: The study revealed that prolonged hospital and intensive care unit stay, higher PRISM score, lower GCS score and the requirement for more inotropic agents might be associated with higher mortality. In addition, the presence of underlying chronic disease contributes to the mortality process and might be associated with mortality.*

***Key words**: Mortality, Children, Pediatric intensive care unit, Comorbidities*

Introduction

Patients with high risk requiring close monitoring should be followed up in pediatric intensive care units and their treatment should be arranged by a pediatric intensive care specialist. The first pediatric ICU was established at Children's Hospital of Goteburg in Sweden (1). Over the following years, pediatric ICUs will be established in many academic institutions and children's hospitals (2). PICUs were established much later in Turkey and there was a lack of proper organization until the mid-1990s (3).

The challenges related to pediatric critical care in developing countries are the low number of beds, limited resources and difficulty in acquiring equipment. Lack of training programs as well as qualified personnel and inadequate commitment by those responsible for planning health services leads to increased mortality and morbidity. While the mortality rate is as low as 2.39 in developed countries, the rates reported in developing countries are much higher (4,5).

Pediatric intensive care services are estimated to contribute significantly to child health in developed countries; without pediatric intensive care services, child mortality would doubling. In countries like Turkey, where child mortality rates are approaching those of developed countries, providing intensive care services to children with a chance of recovery is expected to reduce child mortality (6,7).

This study aimed to assess the demographic and clinical characteristics of the patients who had been admitted to our unit in the last year and to identify the patients who were served as well as to evaluate the outcomes of the patients.

Methods

Study design and patient selection

The study was a retrospective research performed in the Pediatric Intensive Care Unit of Karabük Training and Research Hospital. The study was initiated after the approval of the ethics committee of Karabük University.

Patients who younger than 1 month and older than 18 years, with missing data and without PICU admission were not included in the study.

Data collection

Demographic parameters of children between the ages of 1 month and 18 years who were hospitalized in the PICU of Karabük Training and Research Hospital in the last 1 year were evaluated. The records of 88 patients admitted PICU within one years were retrospectively analyzed. Age, gender, presence of chronic disease, reason for intensive care unit admission, duration of intensive care unit stay, duration of hospitalization, need and duration of HFNC, need and duration of invasive mechanical ventilation, type of nutrition, need for inotropes, service of admission, GCS, nutrition, PRISM (pediatric risk of mortality) score, reason for hospitalization, mortality rates were evaluated. PRISM score includes; systolic blood pressure, diastolic blood pressure, heart rate, respiratory rate, PaO2/ FiO2 value, INR, total bilirubin, calcium, potassium, glucose, bicarbonate values and pupil reaction parameters.

Statistical analysis

IBM SPSS Statistics for Windows version 22.0 (IBM Corp., Armonk, NY, USA) was used to perform all statistical analyses. Ordinal and non-normally distributed data were expressed as median and first and third quartiles (Q1 and Q3). Categorical variables were presented as frequency distributions and percentages (%). The normality of the data was tested using the Shapiro-Wilk and Kolmogorov–Smirnov test. Mann Whitney U test was used in the assess-ment of independent groups that did not comply with the normality test. Spearman correla-tion test was used to evaluate the relationship between ordinal data that were not normally distributed. A p-value of <0.05 was considered statistically significant in all analyses.

Results

88 patients were enrolled to the study. Among these patients, 43 (48.9%) were female. The median age of the patients were 4.5 years [1.0-12.75]. When the diagnoses of the patients admitted to the pediatric intensive care unit were evaluated, it was seen that 37 of the patients (42.0%) were due to upper and lower airway infections such as pneumonia, bronchiolitis and croup, which caused respiratory distress at the highest rate.

The second most common cause was drug intoxication with 16 (18.2%). It was observed that 24 (27.3%) of the patients had a chronic disease. Moreover, 75 (85.2%) of the patients were admitted to

the intensive care unit from the emergency department, while the rest were admitted from the pediatric service, pediatric surgery service and neurosurgery service (Table 1).

Table 1: Sociodemographic features of patients

Parameters		n (%)/n[Q1-Q3]
Age		4.5[1.0-12.75]
Sex	Female	43 (48.9%)
	Male	45(51.1%)
Causes	Drug intoxication	16 (18.2%)
	Pesticide intoxication	2 (2,3%)
	Traumatic brain injury (SAH, subdural hemorrhage, epidural hemorrhage, contusion, etc.)	5 (5,7%)
	Respiratory distress (pneumonia, bronchiolitis, croup etc.)	37 (42.0%)
	Multitrauma	4 (4.5%)
	Postoperative surgical patient	5 (5.7%)
	Status epilepticus	4(4.5%)
	Anaphylaxis	2(2.3%)
	Foreign body in the airway	2(2.3%)
	Acute kidney insufficiency	3(3.4%)
	Sepsis	5(5.7%)
	CO intoxication	1(1.1%)
	Cardiogenic shock	1(1.1%)
	Penetrating-Sharp object injury	1(1.1%)
The underlying chronic conditions		24 (27.3%)
Origin of the patient	Emergency Department	75(85.2%)
	Pediatrics ward	5(5.7%)
	Pediatric surgical ward	5(5.7%)
	Neurosurgery ward	1(1.1%)
	Neonatal Intensive Care Unit	2(2.3%)

While 19.3% of the patients admitted to PICU needed mechanical ventilation support, the median duration of mechanical ventilation was 10.0 [1.5-50.0] days. Also 38.6% of the patients needed high flow nasal cannula oxygen treatment. The median length of stay in the intensive care unit was 4.0 [2.0-6.0] days and the median length of hospitalization was 7.0 [4.0-13.0] days for patients hospitalized in PICU. Most of the patients 80 (90.9%) were fed with enteral nutrition. Furthermore, 10.2% of patients needed inotropic support (Table 2).

Table 2: PICU patients' special requirements and length of stay

		N %
Mechanical ventilation requirement		17 (%19.3)
Days on mechanical ventilation		10.0[1.5-50.0]
High flow nasal cannula requirement		34(%38.6)
Number of days on a high-flow nasal cannula		4.0[3.0-6.0]
Length of stay in pediatric intensive care unit		4.0[2.0-6.0]
Length of hospitalization		7.0[4.0-13.0]
Nutrition pattern	Enteral nutrition	80(%90.9)
	Parenteral nutrition	8(%9.1)
Mortality rate		6(%6.8)
Inotrope requirement		9(%10.2)
PRISM		4[2.0-10.25]
GCS		15[13.0-15.0]

When patients with and without chronic disease admitted to the PICU were evaluated, GCS was significantly lower in patients with underlying chronic diseases ($p<0.001$). PRISM scores of patients with known chronic disease were higher than those of patients without chronic disease ($p= 0.036$). Compared with those who did not die, patients who died in the intensive care unit had a significantly lower GCS score in the group with mortality ($p= 0.004$). PRISM scores of patients with increased mortality were found to be statistically significantly higher ($p<0.001$) (Table 3).

Table 3: Factors affecting mortality as well as their underlying chronic conditions in PICU patients

	The underlying chronic conditions			Mortality		
	Existence	Nonexistence	p	Existence	Nonexistence	p
GCS	12.00[10.25-14.00]	15.00[15.00-15.00]	<0.001	12.00[9.75-13.50]	15.00[14.00-15.00]	0.004
PRISM	6.50[2.25-14.75]	4.00[1.25-6.75]	0.036	17.50[10.50-31.00]	4.00[2.00-7.00]	<0.001
Length of stay in pediatric intensive care unit	6.00[2.00-14.00]	3.00[2.00-5.00]	0.074	26.00[1.00-91.75]	4.00[2.00-6.00]	0.789
Length of hospitalization	13.50[3.00-37.00]	6.5[5.00-10.00]	0.122	32.00[1.00-90.75]	7.00[4.75-12.25]	0.973
Days on mechanical ventilation	1.00[0.00-27.00]	0.00[0.00-0.00]	<0.001	6.50[1.00-90.75]	0.00[0.00-0.00]	<0.001
The count of inotropes	0.00[0.00-2.00]	0.00[0.00-0.00]	<0.001	2.50[1.75-3.00]	0.00[0.00-0.00]	<0.001

As for the correlation of PRISM score with the duration of intensive care unit stay, hospitalization, time on mechanical ventilation and number of inotropic agents

in patients hospitalized in PICU were found a statistically significant positive correlation as r: 0.362 p<0.001, r: 0.347 p<0.001, r: 0.362 p<0.001, r: 0.435 p<0.001 respectively.

In addition, there was a positive correlation between the length of stay on mechanical ventilation support and the parameters including the count of inotropic agents, length of hospital stay, and length of intensive care unit stay (r: 0.706 p<0.001, r: 0.348 p<0.001, r: 0.369 p<0.001 respectively) (Table 4).

Table 4: Correlation test

	Correlation coenfficient (rho)	p
PRISM/ Length of stay in pediatric intensive care unit	0.362	<0.001
PRISM/ Length of hospitalization	0.347	<0.001
PRISM / Days on mechanical ventilation	0.362	<0.001
PRISM/ The number of inotropes	0.435	<0.001
Days on mechanical ventilation/ The number of inotropes	0.706	<0.001
Days on mechanical ventilation/ Length of hospitalization	0.348	<0.001
Days on mechanical ventilation/ Length of stay in pediatric intensive care unit	0.369	<0.001
Length of hospitalization/ The number of inotropes	0.159	0.139
Length of stay in pediatric intensive care unit/ The number of inotropes	0.206	0.054

Discussion

Our study revealed that pediatric patients with underlying chronic conditions had lower GCS scores and higher PRISM scores than patients without comorbidities, and demonstraded that there was no effect on the length of hospital stay and intensive care unit stay. By comparing patients who resulted in mortality with those who could be discharged from the PICU, it was observed that children discharged from the PICU had better initial GCS scores, lower PRISM scores and less requirement for inotropes.

A similar study by Botan et al. observed that the majority of the admissions to the PICU were respiratory problems, which was similar to present study. Likewise, the group with mortality was found to have worse neurologic status at admission. Moreover, the length of hospitalization in the mortality group in our study was longer than in the study by Botan et al. (8). We assume that the difference between the survival times of the patients might have been due to the fact that the patients were followed up in a more compact area and with a steadier team, which could have led to an increase in the survival time.

Unlike both the present study and Botan's study, another study by Kanthimathinathan et al. reported that the most common reason for admission to the PICU was cardiovascular diseases (8,9). In addition, a comparison of mortality rates shows that mortality rates vary between 17% and 31%. The annual mortality rate in our PICU was found to be 6.8%. Although cardiovascular diseases may have an altered effect on mortality, there are many variables that may alter intensive care mortality. We assume that the difference in mortality between Kanthimathinathan's study and this study might be due to the fact that their center was a large quarterry service and they followed up patients with multiple organ failure including cardiac and liver transplantation (9). Because their PICU's are a regional referral centre and also support large quarternary services.

In the study conducted by Tripathi et al, they divided their patients into two groups: those transferred from the emergency department to the PICU and those transferred throughout the hospital, and the proportion of patients transferred from other clinics was relatively higher (10). Respiratory distress ranked first in the distributions of the diagnoses in our clinic. Both studies are similar to each other in terms of patient distribution. According to the present study, 85.2% of the patients were admitted directly from the emergency department to the PICU and the rest were transferred from other clinics. However, the length of stay in the intensive care unit was found to be longer in the study. Six patients who enrolled in the study resulted in death and this represents 6.8% of PICU hospitalizations. According to a study by Volakli et al. comparing early and late mortality rates, the overall mortality rate was found to be 9.7% (11). Also, the mortality rate was found to be 12.9% in the study by Kılıç et al. (12). Also, similar to our study, high values in PRISM score, presence of comorbid diseases and number of days on mechanical ventilation were found to be associated with mortality. In the study by Musick et al. as well as in our study, the risk of mortality increased as the PRISM scores and inotropic requirement of the patients increased (13).

Limitations

Our study was performed with limited data and a small number of cases due to being a recently opened clinic. The retrospective design of the study lead to inadequate access to additional data.

Conclusion

Prolonged hospital and intensive care unit stay, higher PRISM score, lower GCS score, and increased requirement for inotropic agents may be associated with

higher mortality, however, the presence of an underlying chronic disease contributes to the mortality process and associated with mortality.

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