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RESEARCH ARTICLE

Evaluation of Pediatric Patient Admissions and Outcomes in Adult Intensive Care Units Over a 5-Year Period

Azime Bulut[1], Fatma Alkan Bayburt[2], İlke Tamdoğan[3], Muhammet Bulut[4]

[1]Giresun University, Department of Anesthesiology and Reanimation, Giresun, Türkiye
[2]Giresun Training and Research Hospital, Department of Anesthesiology and Reanimation, Giresun, Türkiye
[3]Giresun Women and Children Training and Research Hospital, Department of Anesthesiology and Reanimation, Giresun, Türkiye
[4]Giresun University, Department of Pediatrics, Giresun, Türkiye

ORCID ID: A.B. 0000-0001-8164-5617; F.A.B. 0000-0001-9984-4948; İ.T. 0000-0002-8757-1046; M.B. 0000-0002-5963-1267

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ABSTRACT

Objective: This study aimed to outline the demographic characteristics and mortality rates of pediatric patients managed in the adult intensive care units (ICUs) of Giresun Training and Research Hospital from 2018 to 2023.
Methods: We conducted a retrospective review of records pertaining to 74 patients aged between 6 months and 18 years who were admitted to our ICU and received treatment for 24 h or more. Data collected included patient age, gender, diagnosis, APACHE II scores, requirement for mechanical ventilation, length of stay, Glasgow Coma Scale scores, and mortality rates.
Results: Among the patients included, 59.4% were male, with an average age of 7.79±5.7 years. Most admissions were due to trauma (n = 57, 77.02%). The mean ICU stay was 3.78±3.37 days, and out of the 70 patients who completed their follow-up at our hospital, 4 (5.71%) died.
Conclusions: Similar to global trends, a significant proportion of pediatric intensive care cases in our country are managed in adult ICUs. Mortality and morbidity vary based on the severity of the patient's condition. Consideration should be given to implementing training programs for adult ICU teams until the availability of pediatric ICU beds and specialists is adequate.

Keywords: Pediatric intensive care, adult intensive care, mortality

INTRODUCTION

Pediatric intensive care units (PICUs) are specialized facilities dedicated to the continuous monitoring and support of critically ill infants, children, and adolescents. These units necessitate a larger complement of staff and equipment compared to other medical clinics. As per the 2020 update to the Regulation on the Implementation Principles and Procedures of Intensive Care Services in Healthcare Facilities, pediatric intensive care is described as follows: "Intensive care units (ICUs) for patients older than 28 days but not yet 18 years old, taking into account their age on the application date. These units are equipped with all basic monitoring methods such as ECG, rhythm monitoring, oxygen saturation, blood pressure, pulse, and temperature. They are capable of fluid and blood product replacement, intubation, cardiopulmonary resuscitation, and the initial stabilization of the patient. These units primarily address single organ failure, and they can provide supportive treatments such as hemodialysis and mechanical ventilation" (1).

In essence, PICUs are essential in providing comprehensive care of severely ill pediatric patients, offering a wide array of monitoring and life-support measures. The primary reasons for PICU admissions typically include respiratory issues, neurological conditions, and cases of poisoning, with pediatricians, anesthesiologists, and various surgical teams commonly overseeing their monitoring and treatment. To mitigate mortality and morbidity rates, it is recommended that critically ill pediatric patients receive care in specialized PICUs tailored to their specific needs (2).

The first PICU was established in 1955 at the Goteborg Children's Hospital in Sweden (3). Despite significant advancements globally and within our country, marked by increased technological capabilities and knowledge, the current availability of PICU beds remains insufficient to meet demand.

Corresponding Author: Azime Bulut **E-mail:** cimemazime@yahoo.com.tr
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When pediatric intensive care services are unavailable, there is a necessity for monitoring and treatment within adult ICUs. Data from 2006 indicates that 56% of pediatric patients receive treatment in adult ICUs (2). In 2014, the Pediatric Intensive Care Association reported that Turkey had a pediatric population of 23 million, yet only 600 pediatric intensive care beds were available, with just 29 pediatric intensive care specialists (4). As of 2022, the Ministry of Health announced that there are now 2,308 pediatric intensive care beds (5). In 2014, the Ministry of Health stated that 570–600 pediatric intensive care specialists would be required for the planned 1,138 pediatric intensive care beds. Consequently, addressing the shortage of pediatric intensive care specialists would necessitate several years to ensure continuous 24/7 coverage.

In our study, we evaluated the demographic characteristics, mortality rates, distribution of attending physicians, and requirement for mechanical ventilation among pediatric patients treated in the adult ICUs of Giresun University Training and Research Hospital from January 2018 to December 2023. Our objective was to highlight the difficulties associated with managing pediatric patients in adult ICUs, the resultant effects on mortality, and the imperative for comprehensive planning and targeted objectives in addressing these challenges.

MATERIAL AND METHODS

All patients aged between 6 months and 18 years who were admitted during the 5-year period from January 1, 2018, to December 31, 2023, were considered for inclusion, except for those lacking medical records and staying in the ICU for less than 24 h. Each admission was treated as a distinct case. We collected demographic information including age, gender, reason for admission, type of trauma, Acute Physiology and Chronic Health Evaluation-II (APACHE II) scores, and need for surgical intervention and mechanical ventilation. Additionally, we documented the duration of mechanical ventilation, mortality outcomes, and the attending physician for each patient.

Table 1: Distribution of the attending physician and admission diagnosis

Characteristics	n=74
Admission diagnosis	
Trauma n (%)	57 (77.02%)
Foreign body aspiration n (%)	8 (10.81%)
Spontaneous pneumothorax n (%)	3 (4.05%)
Hydrocephalus n (%)	2 (2.70%)
Drowning n (%)	2 (2.70%)
Epilepsy n (%)	1 (1.35%)
Septic shock n (%)	1 (1.35%)
Attending physician	
Pediatric surgeon n (%)	35 (47%)
Neurosurgeon n (%)	24 (32%)
Anesthesiology and Reanimation n (%)	15 (20%)

Table 2: Clinical characteristics of the patients

Characteristics	n=74
Age (years, mean±SD)	7.79±5.7
Male gender n (%)	44 (59.4%)
Mechanical ventilation (Required patients)	21 (28.37%)
Duration of mechanical ventilation (days, mean±SD)	2.76±3.01
GCS on admission (mean±SD)	12.84±3.91
GCS on discharge (mean±SD)	14.86±0.86
APACHE-II score (mean±SD)	6.63±6.11
Length of stay (days, mean±SD)	3.86±3.55
Mortality (non-survivors, n (%)	4 (5.71%)

GCS:Glasgow coma score, APACHE-II: Acute Physiology and Chronic Health Evaluation

Data analysis

The findings were presented using numerical values and percentages (%). Age, (APACHE II) score, and duration of mechanical ventilation were reported as mean ± standard deviation.

RESULTS

A total of 79 patients admitted to our ICUs were analyzed through the hospital information management system. After excluding 5 patients with unavailable data and those staying less than 24 h, 74 patients were included in the study. Among these patients, 59.4% were male, with an average age of 7.79±5.7 years. Of the admissions, 57 (77.02%) were due to trauma, with 35 patients having undergone surgery. Specifically, 35 patients were admitted by the pediatric surgery department, 15 by the anesthesia and reanimation department, and 24 by the neurosurgery department.

The primary reasons for ICU admission were trauma (77.02%), foreign body aspiration (10.81%), and spontaneous pneumothorax (4.05%). Intracranial trauma was the most common condition among trauma patients. The average Glasgow Coma Scale (GCS) at ICU admission was 12.84 ± 3.91, increasing to 14.96 ± 0.17 at discharge. Among the patients, 21 (28.37%) required mechanical ventilation, with an average duration of 2.76±3.01 days. Of those intubated, 11 (52.38%) were successfully weaned. Four patients were transferred to the PICU in other hospitals for specialized care. The average ICU stay was 3.78±3.37 days.

The calculated APACHE II scores within the first 24 h were 6.63±6.11. Out of the 70 patients who completed their follow-up at our hospital, 4 (5.71%) died.

DISCUSSION

Reasons for admission to the PICU can vary based on the patient demographic of the served population. Given that the province housing Giresun University Training and Research Hospital lacks a dedicated PICU, pediatric patients are typically managed

in adult ICUs. Patients requiring advanced intensive care, particularly those diagnosed with respiratory and neurological conditions, are often referred to PICUs in other facilities. Consequently, the predominant reasons for admission among pediatric patients admitted were trauma or postoperative complications. An analysis of 124 studies revealed a higher admission rate to PICUs for males, potentially indicating lower overall mortality among females in PICU settings (6). Orhan et al. reported a male gender ratio of 51.7% among 938 patients, while Konca and colleagues found a ratio of 56.3% among 770 patients (7-8). In our study, the male gender ratio was 59.4%, aligning closely with existing literature.

Length of ICU stay varies based on admission reasons. In our ICU, where trauma cases are frequent, the average length of stay was 3.86±3.55 days. Prolonged hospitalization in the PICU is influenced by factors such as diagnosis, comorbidities, procedures, severity scores, complications, and the need for mechanical ventilation upon admission (8-9). Indications for mechanical ventilation in pediatric patients include inadequate oxygenation, altered consciousness, need for airway protection, and circulatory failure. Mechanical ventilation need is directly linked to mortality irrespective of the underlying condition. While consensus is lacking on the duration defining prolonged mechanical ventilation, less than 14 days is generally considered non-prolonged. In our study, 21 patients required mechanical ventilation, with an average duration of 2.76 ± 3.01 days.

In a survey by the Turkish Association of Pediatric Emergency and Intensive Care in 2005, PICU mortality was 14% across 16 PICUs (10). Mortality rates in Turkish PICUs range from 2.4% to 34.4%, influenced by factors such as the presence of fellowship-trained specialists, team experience, unit equipment, and admission reasons (7-8, 11). Mortality rates have decreased in recent decades with advancements in treatment methods, monitoring, and knowledge (12). A retrospective study involving 106,464 patients found a 4% mortality rate, with 15% of deceased children expiring within the first 24 h (13). High mortality during these critical hours underscores the importance of emergency services, especially adult ICUs, in stabilizing vital signs and providing maintenance support until patient transfer to the PICU is feasible. Mortality rates in adult ICUs tend to be higher due to elderly and comorbid patients. In a developing country, a PICU mortality rate exceeding 10% may suggest the application of intensive care treatment without proper prognosis and indication (7).

Various scoring systems are utilized in PICUs to predict mortality rates. Notably, the APACHE II, Pediatric Risk of Mortality (PRISM), and Pediatric Index of Mortality (PIM) are extensively studied. Ağın et al.'s research found that the modified APACHE II mortality scoring system demonstrated superior accuracy in predicting death rates compared to APACHE II, PRISM, and PIM scoring systems (14). At our hospital, APACHE II scores are routinely recorded, with an average score of 6.63±6.11 observed in the study. However, due to insufficient number of deceased patients, we could not evaluate the relationship between mortality and APACHE II scores.

In developing countries, trauma ranks the second leading cause of death in children aged 1–4 years, following infections, while in developed countries, it stands as the primary cause of death in children aged 1–14 years (15). Head trauma is frequently encountered among trauma cases and often leads to trauma-related mortality and morbidity (16). Consistent with our findings, head injury emerged as the most prevalent type of trauma in our study. Patients with a low GCS score upon admission tend to experience prolonged stays and increased mortality rates (17). In our study, all deceased patients were admitted with head trauma, with a GCS score of 3 upon admission.

Pediatric patients in our study were primarily admitted by pediatric surgeons, neurosurgeons, and anesthesia and reanimation specialists. Like many countries, 56% of pediatric patients receive treatment in adult ICUs due to the inadequate capacity in pediatric intensive care beds (2). Recognizing this reality, it is crucial for the entire intensive care team to possess comprehensive knowledge of normal physiological values in pediatric patients and the anatomical and physiological distinctions between children and adults. Seamless implementation of protocols for basic and advanced life support, airway management, respiratory and circulatory stabilization, sedoanalgesia, and fluid-electrolyte and nutrition maintenance treatments is essential.

In conclusion, a significant portion of pediatric patients in our country continues to be managed in adult ICUs. Until an adequate number of PICUs and specialists are available to mitigate mortality and morbidity rates, establishing specialized adult intensive care teams for pediatric patient care in centers could be effective. To this end, the Ministry of Health could organize training programs for anesthesiologists, resuscitation specialists, neurosurgeons, and selected nursing teams primarily involved in caring for pediatric patients in ICUs.

Ethics Committee Approval: This study was approved by the Clinical Research Ethical Committee of Giresun Training and Research Hospital (Number: KAEK-255, Date: 2023-12-04).

Informed Consent: Informed consent was not obtained as it was a retrospective study.

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