



## Original Research

# Evaluation of Forensic Cases in the Pediatric Intensive Care Unit

Sinem Polat,<sup>1</sup> Cem Terece,<sup>2</sup> Ayhan Yaman,<sup>1</sup> Kagan Gurpinar<sup>2</sup>

<sup>1</sup>Department of Pediatrics, Istinye University Faculty of Medicine, Pediatric Emergency Care Unit, Istanbul Turkey

<sup>2</sup>Second Forensic Medicine Specialization Board, Council Of Forensic Medicine, İstanbul, Turkey

### Abstract

**Objectives:** Traffic accidents, falls, assaults, occupational accidents, intoxications, burns, electric shock, lightning strike, all cases of asphyxia, penetrating and firearm injuries, suspected or definite cases of sexual abuse, and suicide attempts should be evaluated in the forensic category. In this study, we aimed to present our intensive care experiences in forensic cases.

**Methods:** We retrospectively evaluated forensic cases admitted to our Pediatric Intensive Care Unit between 1 February 2017 and 1 September 2018.

**Results:** This study included 153 children, 65 (42.5%) boys and 88 (57.5%) girls. The forensic causes of hospitalizations in the intensive care unit included drug intoxication with a rate of 54.9%, followed by suicide attempts with 24.2%, falling from a high place with 5.2%, child abuse with 5.2%, pedestrian (out-of-vehicle) traffic accidents with 2.6%, drowning in water with 2.6%, road (in-vehicle) traffic accidents with 2%, electric shocks with 2%, and CO (carbon monoxide) poisoning with 1.3%. The drug intoxication was caused by drugs prescribed to the mother and the child with a rate of 40.6% and 27.1%, respectively. Analgesic anti-inflammatory drugs (33.1%) and antidepressant drugs (22.3%) were identified as major causes of intoxication. In addition, paracetamol was the most common cause of intoxication, with a rate of 21.9% among all intoxication cases and 72.5% in the analgesic group. Amitriptyline was the most common agent in the antidepressant group (59.2%). The admission rate to the intensive care unit between 08:00 and 14:00 was 35.1% for suicide attempts and 16.4% for non-suicide attempts, with a statistically significant difference ( $p=0.025$ ;  $p<0.05$ , respectively).

**Conclusion:** Drug intoxications had the highest rate of forensic cases followed in our pediatric intensive care unit. The majority of these intoxications (69.4%) arose from accidental drug ingestion. Therefore, we believe that there may be a significant decrease in the number of hospitalizations of forensic cases associated with drug intoxications in pediatric intensive care units by preventing children's access to drugs.

**Keywords:** Drug intoxication; forensic case; pediatric intensive care unit; suicide.

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When a situation that we may consider a physical or mental disease occurs in the person who is passively or actively affected as a result of deliberation, imprudence or neglect of a person, this situation is considered to be a "Forensic Case". Accordingly, traffic accidents, falls, cas-

es of battery, workplace accidents, intoxications, burns, electrocution and lightning strike, all types of asphyxia, penetrating, sharp object and firearm wounds, cases or suspicions of abuse and attempted suicides should be considered forensic cases.<sup>[1]</sup>

**Address for correspondence:** Cem Terece, MD. İkinci Adli Tıp İhtisas Kurulu, Adli Tıp Kurumu, İstanbul, Turkey

**Phone:** +90 533 775 55 74 **E-mail:** drcemterece@gmail.com

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Children between 1-18 years old who have poor vital signs or critical diseases are followed up in the pediatric intensive care unit.<sup>[2]</sup> Neurological system and respiratory system diseases are the major causes of hospitalization in pediatric intensive care unit. Therewithal, except those, it seem that the possible forensic cases like intoxication, electric shock, traffic accidents and drowning have a significant ratio.<sup>[3]</sup>

The first treatment of forensic cases usually begins in emergency departments. The majority of these cases are treated as an outpatient, while others are treated as inpatients.<sup>[2]</sup> The treatment of patients who need intensive care from hospitalized patients is continued in intensive care units. In the recent studies, intensive care units were named as one of the clinics where hospitalization forensic cases were followed up frequently.<sup>[4,5]</sup>

In this study, we aimed to examine the demographic characteristics, reasons for hospitalization, times and durations of hospitalization, prognoses and mortality rates of forensic cases that were monitored at the Pediatric Intensive Care Unit (PICU).

## Methods

Our study included pediatric forensic cases aged between 1 and 18 years admitted to our PICU between February 1, 2017, and September 1, 2018. We retrospectively reviewed the records of the patients admitted to the PICU. Therefore, ethics committee approval was not needed. We determined age, gender, length of stay in ICU, centers before admission to the pediatric ICU, forensic causes and mortality rates. In cases of intoxication, we investigated the patients' characteristics, as well as the amount of the drug taken, the person to whom the drug was prescribed, and the type of the drugs. We divided the cases of intoxication into two groups as suicide attempts and non-suicide attempts and performed statistical analysis of the differences between these two groups.

## Statistical Analysis

IBM SPSS Statistics 22 (IBM SPSS, Turkey) was used for the statistical analysis. The normality distribution of the parameters was evaluated using the Shapiro-Wilks test. In addition to descriptive statistics (mean, standard deviation, frequency), when comparing quantitative data, Student's t-test was used for the pairwise comparison of the normally distributed variables, whereas the Mann-Whitney U test was used for the pairwise comparison of the non-normally distributed variables. The Chi-square and Fisher's exact tests and Yates's continuity correction were used to compare the qualitative data. A  $p < 0.05$  value was considered significant.

## Results

In our study, the ages of the forensic cases that were admitted to our PICU between the dates of 1 February 2017 and 1 September 2018 varied between one and 18 years, while the median age of the cases was four years. In this study, 153 children, 65 (42.5%) boys and 88 (57.5%) girls were included.

The duration of IC hospitalization varied from 24 to 576 hours, while the median duration was 72 hours. Of these cases, 37.3% were admitted to intensive care unit between 14:00 and 20:00, 36.6% between 20:00 and 02:00, 20.9% between 08:00 and 14:00, and 5.2% between 02:00 and 08:00. In addition, 96.1% of these patients survived, whereas 3.9% died. Among the six patients who died, three, two and one patients developed cardiac and pulmonary arrest and underwent cardiopulmonary resuscitation due to pedestrian traffic accidents, drowning in water and falling from a high place, respectively. In addition, 24.2% of the patients consisted of children who attempted suicide.

The forensic causes of hospitalizations of children in the intensive care unit include drug intoxication/suicide attempt with a rate of 79.1%, followed by falling from a high place with 5.2%, child abuse with 5.2%, pedestrian (out-of-vehicle) traffic accidents with 2.6%, drowning in water with 2.6%, road (in-vehicle) traffic accidents with 2%, electric shocks with 2%, and CO (carbon monoxide) poisoning with 1.3%.

Among 121 cases with drug intoxication and suicide, the source of the intoxication and suicide drugs could be identified in 59 cases. The drug intoxication arose from medications belonged to the mother with a rate of 40.6%, followed by the child himself with 27.1%, father with 13.6%, a paternal grandmother with 6.8%, maternal grandmother with 5.1%, a grandfather with 1.7% and sibling with 1.7%, whereas 1.7% of drug intoxications occurred with drugs purchased from a pharmacy. Moreover, the findings showed that all non-suicidal drug intoxications arose from accidental ingestion. Furthermore, 33.1% of intoxications were caused by analgesic-anti-inflammatory drugs, 22.3% by antidepressant drugs, 6.6% by antipsychotic drugs, 4.1% by antiepileptic drugs and 33.9% by other drugs. In addition, paracetamol was the most common cause of intoxication, with a rate of 21.9% among all intoxication cases and 72.5% in the analgesic group. Amitriptyline (59.2%) was the most common active substance among antidepressant drugs, whereas risperidone (75%) was the most common active substance among antidepressant drugs.

Of the pediatric patients, 42% were consulted to the Department of Pediatric and Adolescent Psychiatry, 20% to the Department of Neurosurgery, 10% to the Department of Orthopedics and Traumatology, 8.7% to the Department of Pediatric Cardiology, 6.2% to the Department of Otolaryn-

gology, 6,2% to the Department of Pediatric Surgery, 2,5% to the Department of Thoracic Surgery, and 3,7% to other departments.

The mean age of those who attempted suicide was significantly higher than those who did not ( $p=0.000$ ;  $p<0.05$ ).

There was no statistically significant difference between the patients who attempted suicide and patients who did not concerning the length of stay in the ICU ( $p>0.05$ ).

The rate of female gender among the patients who attempted suicide (81.1%) was statistically significantly higher than the rate among the patients who did not (50%) ( $p=0.002$ ;  $p<0.05$ ).

There was a statistically significant difference between the rates of patients who attempted suicide (35.1%) and who did not (16.4%) concerning the admission to ICU between 08:00 and 14:00 ( $p=0.025$ ;  $p<0.05$ ).

Finally, 100% of those who attempted suicide and 94.8% of those who did not attempt suicide survived, with no statistically significant difference ( $p>0.05$ ) (Table 1).

## Discussion

In our country, most of the forensic cases are reported in emergency departments. Forensic cases account for 4% of all emergency cases.<sup>[6]</sup> Among all forensic cases, pediatric forensic cases have rates ranging from 18% to 31% in the

studies.<sup>[7-9]</sup> In our pediatric intensive care unit, 558 patients were followed for 19 months, of which 153 (27.4%) were forensic cases. Özdemir et al.<sup>[10]</sup> reported that 81% of the forensic cases admitted to the pediatric emergency department received outpatient treatment, and only 12% continued their inpatient treatment. Compared to the pediatric emergency department, low rates of forensic cases in our intensive care unit can be attributed to the administration of outpatient treatment in most of the forensic cases admitted to the emergency department.

In our study, forensic cases monitored in the intensive care unit were mostly female patients. The ratio of suicide attempts to all forensic cases was 24% in our study. The ratio of female gender among suicide attempters is 81.1%, which may explain the high percentage of female gender among all forensic cases. Indeed, the studies indicated that the male gender constitutes the majority of forensic cases admitted to pediatric emergency services.<sup>[9-11]</sup>

Poyrazoglu et al.<sup>[12]</sup> reported that the mean length of hospital stay in the PICU was 66 hours, and 48 hours in surviving cases. In our study, the median duration of hospitalization of the cases at our PICU was 72 hours, which was similar to this study. In our study, two of the cases of suspected child abuse were associated with asphyxia. One of these cases was followed in our clinic for eight weeks and the other for five weeks.

For forensic cases, the most frequent time intervals for admission to the PICU were 14:00 to 20:00 (37%) and 20:00 to 02:00 (36%). The most frequent hours of admission to the pediatric emergency department in the literature were similar to those in our study.<sup>[13-15]</sup> Most of the patients admitted to the PICU were transferred from pediatric emergency departments, which may explain similar rates in terms of periods of hospitalization. For forensic cases, the lowest admission frequency to the PICU was between 02:00 and 08:00 (5%). We believe that being unaware of intoxication with drugs at early hours in the day contributes to this low rate.

Mortality rates in pediatric intensive care units range from 4.7% to 19%.<sup>[3,16,17]</sup> In our study, the mortality rate was lower than the literature (3.9%). Among our cases, most of them were related to intoxication and attempted suicide. We believe that the mortality rate in our study was lower because these patients have a lower risk of mortality in comparison to children with neurogenic and infection-related problems who are mostly monitored at pediatric intensive care units. Likewise, Konca et al.<sup>[18]</sup> reported that 68% of the patients followed up in pediatric intensive care units consisted of patients with neurological and infectious diseases.

Demir et al.<sup>[19]</sup> reported that 76% of forensic cases admitted to pediatric emergency departments were associated

**Table 1.** Evaluation of study parameters according to suicide attempt

	Suicide attempt		p
	Yes X±SD	No X±SD	
Age	14.32±3.27	5.13±4.75	<sup>1</sup> 0.000*
IC hosp. duration (h)	57.41±24.35 (72)	48 (median)	<sup>2</sup> 0.419
Gender, n (%)			
Male	7 (18.9)	58 (50)	<sup>3</sup> 0.002*
Female	30 (81.1)	58 (50)	
Time of admission to IC, n (%)			
08:00-14:00	13 (35.1)	19 (16.4)	<sup>4</sup> 0.025*
14:00-20:00	7 (18.95)	50 (43.1)	
20:00-02:00	15 (40.5)	41 (35.3)	
02:00-08:00	2 (5.4)	6 (5.2)	
Outcome, n (%)			
Survived	37 (100)	110 (94.8)	<sup>5</sup> 0.337
Dead	0 (0)	6 (5.2)	

<sup>1</sup>: Student's t-test; <sup>2</sup>: Mann-Whitney U test; <sup>3</sup>: Continuity (Yates) Correction; <sup>4</sup>: Chi-squared test; <sup>5</sup>: Fisher's exact test \* $p<0.05$ . The mean age of those who attempted suicide was significantly higher than those who did not ( $p=0.000$ ;  $p<0.05$ ).

with traffic accidents and 13% with falls from a high place. Another study reported that 32% of the forensic cases admitted to the pediatric emergency department were associated with traffic accidents, 17% with falls from a high place, and 20% with intoxication and suicide attempts. In the same study, 47% of the forensic cases admitted to the emergency department received outpatient treatment and were discharged.<sup>[5]</sup> We concluded that the low rate of 5% of the traffic accidents among the forensic cases followed in our PICU might be related to the absence of the need for medical care in the intensive care unit.

Drug intoxication is one of the most important reasons for admission to pediatric emergency departments. Some cases of intoxication may need to be followed in the PICU based on clinical features, drug properties and recommendations of the poison counseling center. Since these patients frequently apply to emergency departments, there are a large number of patients followed up in pediatric intensive care units. The cases of intoxication had the highest frequency, with a rate of 54.9% among forensic cases admitted to our pediatric intensive care unit. Studies have reported rates ranging from 2 to 20% for intoxications among forensic cases admitted to emergency departments.<sup>[5,10,19,20]</sup>

In our study, the high rates of intoxications were attributed to the low age of the majority of drug intoxication cases, the necessity of follow-up in the intensive care unit and the characteristics of drugs. In addition, Sever et al.<sup>[5]</sup> reported that 10% of forensic cases admitted to the pediatric emergency department were hospitalized in the intensive care unit, and forensic cases admitted to the pediatric emergency department were most often hospitalized in pediatric intensive care units. The difference between the rates of forensic cases admitted to the emergency departments and followed in the pediatric intensive care units was attributed both to the administration of outpatient treatment in most of the forensic cases and the need for follow-up in the intensive care unit in a small majority of forensic cases admitted to the pediatric emergency departments. In addition, 52% of the forensic cases followed in the pediatric intensive care unit were consulted to one or more departments. The most frequently consulted department was a child and adolescent psychiatry (42%). In our clinic, all cases of suicide attempts were consulted to the child and adolescent psychiatry department for examinations and recommendations before transfer to the ward. Since suicide attempts accounted for 24% of our cases, a high rate for consultation with the department of child and adolescent psychiatry can be expected.

Although drug intoxications may occur at any age, they are more common in childhood.<sup>[5]</sup> One study reported that the most common accidents in childhood were traffic acci-

dents, falls, burns and intoxications, respectively.<sup>[22]</sup> Intoxications may occur most frequently in males by the age of five, usually due to the intake of a single substance. Drug intoxications during adolescence are usually caused by the intake of multiple drugs, most of which are associated with suicide attempts and are more common in the female gender.<sup>[23, 24]</sup> The mean age of the patients who attempted suicide was  $14.32 \pm 3.27$  years, of which 81% were female. The patients who did not attempt suicide had an average age of  $5.13 \pm 4.75$  years and a male/female ratio of 1. Although studies have shown that the male gender has a higher rate in cases of intoxication under the age of five, this difference was not observed in our study. The inclusion of cases of drug intoxications over five years of age in our study may explain the absence of this difference. While 80-85% of drug intoxications in childhood were reported to be related to accidental drug intake and 15% to suicide attempts, the findings showed that 70% of forensic intoxication cases followed up in our PICU were related to accidental drug intake and 30% were related to suicide attempts.<sup>[25]</sup>

Çam et al.<sup>[26]</sup> reported that analgesic-antipyretic drugs were the most common cause of drug intoxications admitted to emergency departments, followed by drugs acting in the central nervous system. Other studies in our country have shown that paracetamol is the most common agent in drug intoxication in children, followed by amitriptyline.<sup>[27-31]</sup> Although a study in the USA indicated that analgesic drugs were the most common agents in drug intoxications, another study in Burkina Faso found that antimalarial drugs were the most common agents in drug intoxications.<sup>[32-33]</sup> Accordingly, it can be hypothesized that the geographical conditions of countries and endemic diseases have an impact on the frequency of agents detected in drug intoxications. In our study, the findings showed that analgesic-anti-inflammatory (most commonly paracetamol) drugs had the highest frequency (40%) in the cases of drug intoxication followed up in the pediatric intensive care unit, followed by antidepressant drugs (most commonly amitriptyline). Our results were consistent with results in the literature. Risperdal (75%) was the most commonly used antipsychotic agent in suicide attempts.

Accidental drug intake is common in children under five years of age because they tend to get to know their surroundings and exhibit very active and tampering behaviors. The frequency of this condition increases if the parents have a low level of awareness and education and affected mental states for different reasons.<sup>[34-35]</sup> In our study, owners of drugs that cause intoxication, which could be identified in 59 cases, showed that the drugs belonged to their mothers by 40.6%, fathers by 13.6%.



The mortality rates of pediatric intensive care units in Turkey varies between 15% and 34%.<sup>[36-37]</sup> In our study, the mortality rate was 3.9% in forensic cases admitted to our pediatric intensive care unit. The reason for the low mortality rate in our study compared to other studies may be the high rate of drug intoxication cases. Likewise, Konca et al.<sup>[18]</sup> found a low mortality rate of 2.4% in their pediatric intensive care units, which was attributed to the high number of drug intoxication cases followed in their clinics.

### Limitations

In our study, drug levels in the blood could not be studied. Thus, no results were obtained regarding toxicity data. The findings showed that the drugs of the parents were the most common causes of intoxication. However, in our retrospective study, we were unable to examine the awareness of parents about the potential adverse effects of accidental drug intake on children and the adequacy of their behavioral measures to prevent these adverse effects. Our study was a single-center study that was limited to a period of 19 months. To obtain further data, similar multi-center and longer-term studies are required.

### Conclusion

Drug intoxications had the highest rate of forensic cases followed in our PICU. The majority of these intoxications (69.4%) were caused by accidental drug ingestion. Therefore, we believe that there may be a significant decrease in the number of hospitalizations of forensic cases associated with drug intoxications in pediatric intensive care units by preventing access of children to drugs.

### Disclosures

**Ethics Committee Approval:** This was a retrospective study and the patient files were examined for this study and no procedure was performed other than routine follow-up and examination. Therefore, ethics committee approval was not needed.

**Peer-review:** Externally peer-reviewed.

**Conflict of Interest:** No conflict of interest is declared by the authors.

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